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A Comparison of Methods for Determination of Moisture in Textiles[1]

Review of Previous Work—Description of Apparatus and Methods—Description of Samples—Tests and Test Results—Conclusions

By H. A. HAMM and D. A. JESSUP

ABSTRACT

The moisture content of cotton, jute, manila and wool was determined, first, by drying in an air oven; second, by drying in two types of conditioning ovens; third, by distilling with toluene, and, fourth, by drying over sulphuric acid. The results obtained by drying in the air oven, by drying in the small laboratory conditioning oven and by drying over sulphuric acid were in good agreement. The toluene distillation method gave slightly higher results. The large conditioning oven gave variable results. However, all of the methods appear to be suitable for routine purposes.

I. Introduction

THE moisture content of textile fibers is usually taken into consideration when they are bought and sold. In this work it was desired to learn how nearly the results obtained by the several methods for determining moisture agree. For this purpose it was not essential to know the absolute amount of moisture in the fibers.

Although this subject has received the attention of other workers, it was thought desirable to study it further in this laboratory. The results of determining the moisture content of cotton, jute, manila, and wool (1) by drying in an air oven, (2) by drying in two types of conditioning ovens, (3) by distilling with toluene, and (4) by drying over sulphuric acid are compared in this paper.

II. Review of Previous Work

Grabner[2] discussed moisture in relation to textiles, and gave the results of his experiments on drying rayon and silk at elevated temperatures. He used a temperature of 120° C. for drying rayon and 140° C. for drying silk. G. Baroni[3] determined the weight of the four types of rayon in the conditioned state. He dried these weighted samples to constan tweight at 105° to 110° C. and termed this the absolute weight. Following this he exposed the samples to 65% relative humidity, weighted them at suitable time intervals, and designated the moisture taken up as the per cent moisture. F. C. Niederhauser[4] claimed that water can be distilled out of rayon with a constant boiling mixture of toluene and water, giving results that are in fair agreement with those obtained by the lengthy oven drying processes. J. Obermiller[5] and M. Goertz described an apparatus for the "exact" drying of textiles. They dried air by passing it over anhydrous calcium chloride and then over phosphorous pentoxide. The textiles were dried by heating in a special oven through which the dry air was continously passed. The textile could be dried at any temperature below its decomposition point; the higher the temperature the more rapid was the drying. A drying period of 3 to 5 hours together with a temperature of 85° to 90° C. was recommended.

Several investigators have compared the moisture content of other substances determined by various methods. In drying flour L. H. Bailey[6] and C. E. Mangles found that when drying was done in a vacuum oven higher results were obtained than when drying in an air oven; when drying in an air oven higher results were obtained than when drying in a water oven.[7] H. Synder[8] and B. Sullivan showed that when the moisture in flour was determined by various methods different results were obtained. In general, drying in a vacuum oven removed

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[1] Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

[2] Grabner, Melliand's Textilber, 5, 28 (1923).

[3] G. Baroni, Amer. Silk Jour., 43, No. 6, 80 (1924).

[4] F. C. Niederhauser, Rayon, 4, No. 1, 24 (1927).

[5] J. Obermiller and M. Goertz, Z. Angew. Chem., 36, 429 (1923), and 37, 940 (1924).

[6] L. H. Bailey and C. E. Mangels, Cereal Chem., 1, 190 (1924).

[7] An oven surrounded by a bath of boiling water to control the temperature

[8] H. Snyder and B. Sullivan, Ind. Eng. Chem., 16, 741 and 1163 (1924), 17, 311 (1925)

more water than drying over sulphuric acid which, in turn, gave a higher percentage of moisture than drying in an air oven. A water oven gave the lowest result. J. M. Jones[9] and T. McLachlan investigated the determination of moisture in foodstuffs by the solvent distillation method. Their results showed that distillation with toluene gave higher values than distillation with benzene or petroleum ether (b. p. 104° C.), and also higher results than drying in the air and water oven. No definite relation was found between the results of the toluene distillation method and the vacuum oven method. Xylene was found to be unsuitable for use in the distillation method since decomposition of the material being analyzed occurred in certain instances. Toluene was found to give the most consistent results in the solvent distillation method, but was believed to remove water of hydration in addition to the hygroscopic moisture. In the experiments of the investigators named above the air oven was usually heated to a higher temperature than the water oven. In this connection, the work of the members of the Association of Official Agricultural Chemists must be noted. They have investigated the moisture content of foodstuffs by various methods and the results of their numerous experiments are reported in their journal.[10]

III. Description of Apparatus and Methods

It is not thought advisable to give a lengthy discussion of apparatus and methods since ordinary apparatus and procedures were used. The air oven was a laboratory oven equipped with a fan to circulate the air. In this oven, the samples were dried at 104° to 105° C. continuously for five hours after which they were weighed and then dried for one-hour intervals to constant weight.[11] All weighings of the dried samples were made in weighing bottles.

The conditioning ovens used are similar to those described by Matthews[12]. The larger one is of cylindrical shape, stands approximately 4 feet high, is electrically heated, and its temperature is controlled by a bimetallic regulator. The sample is placed in a basket provided for the purpose inside the oven. In this oven, a sample weighing 1,000 grams or more may be tested. The argument has been advanced that this oven is the best to use because the larger the sample the more representative it is of the material tested. A balance was also attached to this oven so all weighings could be made while the sample was in the oven, thus preventing the sample from taking up moisture before the final weighing. This oven will be designated the large conditioning oven.

The other was a laboratory conditioning oven and was also equipped with a balance so that the weighings could be made in the oven. The samples tested in these ovens were dried to constant weight at 100° to 105° C.

The usual apparatus[13] for the toluene distillation method was not used, but a form modified by S. F. Acree was

[9] J. M. Jones and T. McLachlan, Analyst, 52, 383 (1927).
[10] J. O. A. C. Years 1908 through 1928.
[11] To within 0.3 mg.
[12] J. M. Matthews, Textile Fibers, 4th Edition, page 949.
[13] Bureau of Mines Technical Paper No. 323 (1923), "Specifications for Petroleum Products and Methods of Testing," page 65.

TABLE 1

Comparison of Results Obtained in Determining Moisture in Cotton, Jute, Manila and Wool by Different Methods

Sample and Method Used	Sample Weight Average	Moisture Content — Maximum	Moisture Content — Minimum	Moisture Content — Aver. of Six Tests	Difference from Desiccator Method (Moisture)
COTTON—					
Air oven	6.2000 g.	6.42%	6.29%	6.33%	—0.07%
Large conditioning oven	353.7	6.06	5.79	5.91	—0.49
Laboratory conditioning oven	20.00	6.47	6.39	*6.43	+0.03
Toluene distillation	33.00	7.09	6.66	6.81	+0.41
Desiccation over H_2SO_4	1.1000	6.45	6.34	*6.40	...
JUTE—					
Air oven	6.3000	11.59	11.32	11.45	+0.35
Large conditioning oven	771.3	12.11	11.85	12.00	+0.90
Laboratory conditioning oven	32.00	11.40	11.19	11.31	+0.21
Toluene distillation	37.00	12.68	12.11	12.47	+1.37
Desiccation over H_2SO_4	1.1000	11.19	10.99	*11.10	...
MANILA—					
Air oven	5.2000	9.95	9.34	9.57	+0.16
Large conditioning oven	544.3	10.16	9.80	*10.05	+0.63
Laboratory conditioning oven	25.00	9.61	9.01	9.35	—0.06
Toluene distillation	27.00	10.16	9.46	9.75	+0.34
Desiccation over H_2SO_4	1.2000	9.54	9.36	9.41	...
WOOL—					
Air oven	5.6000	11.55	11.15	11.28	—0.06
Large conditioning oven	412.2	12.17	11.07	11.72	+0.38
Laboratory conditioning oven	20.00	11.80	11.44	11.59	+0.25
Toluene distillation	30.00	13.19	12.17	12.64	+1.30
Desiccation over H_2SO_4	0.9500	11.56	11.19	11.34	...

*Average of five tests.

employed. In this modified apparatus all joints are of ground glass, and the condenser is so arranged that the condensate is discharged in the center of the distillation tube, and below the surface of the liquid when the tube is full. The weighed sample was immersed in the toluene and the heating continued until no further water was observed to be distilling over. The water was cooled to room temperature and its volume was noted.

The experiments in which the drying was done by means of sulphuric acid were carried out at atmospheric pressure and room temperature. Ninety-eight per cent sulphuric acid was used in ordinary desiccators. This acid was agitated from time to time and was changed after the samples had become nearly dry. Drying was then continued until constant weight was obtained. Weighing of the dried samples was done in weighing bottles.

IV. Description of Samples

Cotton yarn, jute, twine, manila rope, and wool underwear tubing were selected for these studies since they were easily obtainable and are representative of textiles tested at the bureau. The cotton yarn was in the gray, i. e., it had not been chemically processed. The jute was ordinary post-office twine. The manila rope sample was untwisted, and the fibers were thoroughly mixed in order to obtain a representative test sample. The wool tubing was tested in the piece. No attempt was made to remove any non-fibrous materials such as oils, for only a comparison of methods was being made, and not a determination of actual regain.

V. Tests and Test Results

The moisture in these samples was determined by the five methods described above. Six single tests were run on each sample by each method to find what the variations would be between separate tests. Three different sizes of cotton samples were tested in the large conditioning oven, the object being to see what effect the size of the sample had on the results. All samples were conditioned at 65% relative humidity and 21° C. before the initial weighing. The results of these tests are given in Tables I and II.

TABLE 2

Effect of Sample Size on Results Obtained with the Large Conditioning Oven

(Sample—Cotton; Method used—Large conditioning oven.)

Sample Weight Average	Moisture Content — Maximum	Minimum	Aver. of Six Tests
80.0 g.	6.20%	6.07%	*6.12%
160.0 g.	6.28	5.75	5.97
353.7 g.	6.06	5.79	5.91

*Average of five tests.

VI. Conclusions

The variations in results of separate tests obtained by the air oven, the laboratory conditioning oven, and drying over sulphuric acid were generally small. The toluene distillation method and the large conditioning oven showed a wider divergence betwen individual tests. However, all of the methods appear to be suitable for routine purposes. As a rule, the air oven and the laboratory conditioning oven gave results in good agreement with the desiccator method. The desiccator method (for the sake of convenience) was considered the reference method. The toluene distillation method gave results consistently higher than the desiccator method. No simple relation was found between the results obtained by the large conditioning oven and by the desiccator method. A considerable variation in the size of the sample does not affect the results in the large conditioning oven method. Work is under way to attempt to determine the absolute moisture content of texiles.

Soaps

The Compounds and Elements—The Alkaline Materials—Chemistry of Carbon Compounds—Stearic Acid—Drying Oils and Glycerides

By J. M. HOOD

[*Editorial Note—This article was written especially for dyers, finishers and salesmen who have not had the benefit of a technical education but who would like to increase their knowledge in regard to the chemical nature of soaps and their uses in the textile industry.*]

THE following soaps are the common soaps met in the textile industry: soda tallow, soda red oil, soda olive, soda palm, soda cocoanut oil, potash olive soap and potash red oil soap. Soaps such as cottonseed oil soap, castor oil soap and a few others are in use to a limited extent and will not be considered here. A specially prepared castor oil soap known as sulphonated castor oil or Turkey Red oil and under other trade names is much employed, but is not a true soap and will not be considered at the present time.

A chemist can take table salt, which he calls sodium chloride, and by chemical treatments obtain from it a white shining metal he calls sodium and a gas he calls chlorine, one of the war gases; but he cannot by any known means break down the sodium or the chlorine into any simpler material.

From iron rust can be obtained black iron and a gas oxygen, a gas which makes up 20% of the air we breathe. Both the iron and oxygen thus obtained cannot by any known chemical means be broken down into simpler substances. From black copper oxide we can obtain the metal copper so familiar in our radio sets and the gas oxygen already mentioned, but cannot break down the copper into any other body. Water can be broken down into its component parts and we obtain gaseous hydrogen, for use in our balloons, and gaseous oxygen, which we must breathe to live. As in the preceding examples, we cannot break down the hydrogen into any other body.

To the chemist, table salt, iron rust, copper oxide and water are compounds, but the materials obtainable from them—metallic sodium, gaseous chlorine, metallic iron, gaseous oxygen, metallic copper and gaseous hydrogen—are elements; that is, they are the elementary substances from which these various compounds are made up.

INTERNATIONAL ATOMIC WEIGHTS

Name and Symbol	*Atomic Weight*	*Name and Symbol*	*Atomic Weight*
Aluminum (Al)	27.10	Molybdenum (Mo)	96.00
Antimony, stibium (Sb)	120.20	Neodymium (Nd)	144.30
Argon (A)	39.00	Neon (Ne)	20.20
Arsenic (As)	74.96	Nickel (Ni)	58.68
Barium (Ba)	137.37	Niton, Ra emanation (Nt)	222.40
Bismuth (Bi)	208.00	Nitrogen (N)	14.01
Boron (B)	11.00	Osmium (Os)	190.90
Bromine (Br)	79.92	Oxygen (O)	16.00
Cadmium (Cd)	112.40	Palladium (Pd)	106.70
Caesium (Cs)	138.81	Phosphorus (P)	31.04
Calcium (Ca)	40.07	Platinum (Pt)	195.20
Carbon (C)	12.005	Potassium, kalium (K)	39.10
Cerium (Ce)	140.25	Praseodymium (Pr)	140.90
Chlorine (Cl)	35.46	Radium (Ra)	226.00
Chromium (Cr)	52.00	Rhodium (Rh)	102.90
Cobalt (Co)	58.97	Rubidium (Rb)	85.45
Columbium, niobium (Cb)	93.50	Ruthenium (Ru)	101.70
Copper (Cu)	63.57	Samarium (Sa)	150.40
Dysprosium (Dy)	162.50	Scandium (Sc)	44.10
Erbium (Er)	167.70	Selenium (Se)	79.20
Europium (Eu)	152.00	Silicon (Si)	28.30
Fluorine (F)	19.00	Silver, argentum (Ag)	107.88
Gadolinium (Gd)	157.30	Sodium natrium (Na)	23.00
Gallium (Ga)	69.90	Strontium (Sr)	87.63
Germanium (Ge)	72.50	Sulphur (S)	32.06
Glucinum, beryllium (Gl)	9.10	Tantalum (Ta)	181.50
Gold, aurum (Au)	197.20	Tellurium (Te)	127.50
Helium (He)	4.00	Terbium (Tb)	159.20
Holmium (Ho)	163.50	Thallium (Tl)	204.00
Hydrogen (H)	1.008	Thorium (Th)	232.40
Indium (In)	114.80	Thulium (Tm)	168.50
Iodine (I)	126.92	Tin, stannum (Sn)	118.70
Iridium (Ir)	193.10	Titanium (Ti)	48.10
Iron, ferrum (Fe)	55.84	Tungsten, wolframium (W)	184.00
Krypton (K)	82.92	Uranium (U)	238.20
Lanthanum (La)	139.00	Vanadium (V)	51.00
Lead, plumbum (Pb)	207.20	Xenon (Xe)	130.20
Lithium (Li)	6.94	Ytterbium (Yb)	173.50
Lutecium (Lu)	175.00	Yttrium (Yt)	89.00
Magnesium (Mg)	24.32	Zinc (Zn)	65.37
Manganese (Mn)	54.93	Zirconium (Zr)	90.60
Mercury, hydrargyrum (Hg)	200.60		

The atomic weights represent no definite units of weights, such as tons, pounds or grams. They show us as atomic weights the relationship which exists between the atomic weight of an element when compared with that of another. When making chemical calculations we can give to the atomic weights a unit of weight, but must maintain the same unit throughout any set of calculations. Every time an atom of oxygen is used in a calculation we can figure it as 16 pounds of oxygen, or 16 tons, or 16 grams, but we must not use it as pounds in one place in the same calculation and as tons in another.

This world of ours is known to contain ninety-two elements. They exist as the element itself or in the form of compounds resulting from the union of various elements. The attached table is a table of the elements as compiled in 1910, and shows the name of the element, its symbol and its atomic weight. By the atomic weight is really meant the weight of the element, but instead of element weight we call it atomic weight. Symbols are used by chemists to represent the elements, and do for the chemist what shorthand does for the stenographer. The name of the element is replaced by a short symbol, thus saving time and space in writing. The atomic weight of oxygen is 16, and you will notice that hydrogen has the atomic weight of 1.008, indicating that hydrogen is much lighter than oxygen. It is because of its lightness that hydrogen gas is used in balloons. Helium, another gas, is a little heavier than hydrogen and much more expensive, but when available is used in balloons because it will not burst into flame as hydrogen may do. The United States zeppelins are helium-filled, the German hydrogen.

Note the atomic weights of the metals copper, iron and lead. Their atomic weights are much heavier than oxygen and they are heavy metals.

More than 99% of the terrestrial matter is made up of eighteen or twenty elements, of which the quantities of the first eleven are:

Oxygen	49.98%	Potassium	2.23%
Silicon	25.30%	Hydrogen	0.94%
Aluminum	7.26%	Titanium	0.30%
Iron	5.08%	Carbon	0.20%
Calcium	3.51%	Sodium	2.28%
Magnesium	2.50%		

Thus out of our table of the elements we find that most of them occur but rarely in the earth.

In the manufacture of textile soaps we use the following materials: Caustic soda, caustic potash, carbonate soda (soda ash), carbonate potash, ammonia, neutral glycerides or fat, and fatty acids derived from fats by special processes.

In the case of caustic soda the chemical formula is written NaOH and is known as the molecular formula. It signifies that in caustic soda (NaOH) we have combined together to form the molecule of caustic soda 1 atom

of sodium (atomic weight 23), 1 atom of oxygen (atomic weight 16), 1 atom of hydrogen (atomic weight 1.008); or, in other words, the molecular weight of caustic soda is equal to 23 + 16 + 1, or 40. In making chemical calculations we may have 23 pounds sodium plus 16 pounds oxygen plus 1 pound hydrogen, giving us 40 pounds of caustic soda, or we may substitute for pounds any other unit of weight.

In the case of caustic potash the molecular form is KOH, and we have combined together 1 atom of potash, 1 atom of oxygen and 1 atom of hydrogen, or a molecular weight of 39.1 + 16 + 1, or 56.1. (Atomic weights: K = 39.1; O = 16; H = 1; KOH = 56.1.) Here again the weights may be expressed in any units, such as pounds, tons, grams.

In the case of carbonate of soda we have the molecular formula Na_2CO_3, signifying that 2 atoms of sodium, 1 atom of carbon and 3 atoms of oxygen make up the molecule, and the molecular weight is 2 (23) + 12 + 3 (16), or 106.

In the same way the molecular weight for carbonate of potash is 2 (39.1) + 12 + 3 (16), or 138.2.

With ammonia we find the molecular formula to be NH_3, indicating that it is composed of 1 atom of nitrogen (N—atomic weight 14.01) and 3 atoms of hydrogen (atomic weight 1), or the molecular weight for ammonia (NH_3) is 17.

The Alkaline Materials

Caustic soda and caustic potash, carbonate of soda and carbonate of potash, and ammonia are chemicals coming under that branch of chemistry known as inorganic chemistry, and are known as alkalies or alkaline materials. These materials in water solution have a soapy feeling and will turn a piece of litmus paper from red to blue. Substances causing these two effects are called alkalies, and the soapy feeling and the action on litmus are tests for alkalies. The word "base" is also sometimes used for alkali.

In commerce, carbonate of soda and carbonate of potash occur as solids, usually in the form of coarse powder; caustic soda and caustic potash occur in the solid condition and as water solutions of varying strengths, while ammonia occurs as a liquid. Care should be taken in the handling of these chemicals to prevent serious accidents, especially in the case of caustic soda, caustic potash and ammonia.

We also have in inorganic chemistry substances which in water solution possess a sour taste and instead of turning red litmus blue turn blue litmus red. These substances are known as acids, three of the important ones being nitric acid (HNO_3), composed of 1 atom of hydrogen, 1 atom of nitrogen and 3 atoms of oxygen, the molecular weight being 1 + 14 + 3 (16), or 63; sulphuric acid (H_2SO_4), composed of 2 atoms of hydrogen, 1 atom of sulphur and 4 atoms of oxygen, with a molecular weight of 2 (1) + 32 + 4 (16), or 98; and hydrochloric acid (HCL), composed of 1 atom of hydrogen and 1 atom of chlorine, with a molecular weight of 1 + 35.46, or 36.46. In commerce the acids are found as liquids, and care must be used in handling them, as serious accidents may occur through mishandling.

When an acid solution is added to an alkaline solution, a salt is formed in the solution as the result of the combining of the alkali and the acid. If the proper amounts of acid and alkali are used, red litmus will not turn blue, showing the presence of free alkali, and blue litmus will not turn red, showing the presence of free acid. Having neither free acid nor free alkali in the solution, we have what the chemist calls a neutral solution (neither acid nor alkaline), and the solution contains nothing but the salt formed by the reaction of the acid and alkali. To illustrate this point, a solution of sodium chloride (which is the trade name for common salt or table salt) results when a caustic soda solution and hydrochloric acid solution are brought together in the proper ratio to produce a solution neutral to litmus. This formation of a salt may be illustrated by the chemical equation NaOH + HCL = NaCL + H_2O, which further translated means that 1 molecule of caustic soda + 1 molecule of hydrochloric acid will give 1 molecule of sodium chloride (table salt or rock salt) + 1 molecule of water; or 40 pounds caustic soda or any other unit of weight + 35.46 pounds hydrochloric acid will give 58.46 pounds of sodium chloride (table salt or rock salt) + 18 pounds of water.

As an actual fact, this reaction would take place in water, the caustic soda and hydrochloric acid being dissolved in water. If they were not, the reaction would be so vigorous that an explosion might result.

In the manufacture of soaps a reaction similar to the formation of salt from caustic soda and hydrochloric acid takes place, only a different type of acid, known as a fatty acid or organic acid, takes the place of the hydrochloric.

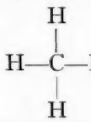
Caustic soda, caustic potash, carbonate soda, carbonate potash and ammonia come under the branch of chemistry known as inorganic chemistry, but the fats and fatty acids used in the manufacture of soaps come under the branch known as organic chemistry.

Chemistry of Carbon Compounds

To-day organic chemistry is defined as the chemistry of the carbon compounds, although in the olden days it dealt with only the chemistry of substances originating from plant or animal life. At that time it was thought impossible to produce organic materials from inorganic, but since then it has been found possible to do so. The elements which are met with in organic chemistry, in addition to carbon, are hydrogen, oxygen, chlorine, bromine, nitrogen, sulphur and occasionally other elements.

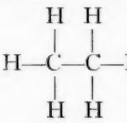
Methane has the formula CH_4, and therefore consists of 1 atom of carbon and 4 atoms of hydrogen, and has a molecular weight of 12 + 4 (1) = 16. This is one of

the simplest organic compounds and is the starting point of a series of organic compounds known as the aliplatic compounds. Methane is pictured as having a carbon atom from which four prongs protrude, to each of which a hydrogen atom is attached, thus:

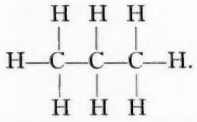


These prongs may be considered as representing the electrical charges upon the carbon atom, and must always be accounted for.

The next compound in the series is ethane (C_2H_6), and contains 2 carbon atoms and is represented by the formula



The next compound is propane (C_3H_8), and is represented by the formula



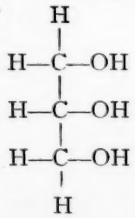
And so on, one compound containing 60 carbon atoms and 122 hydrogen atoms and the structural formula would be represented by 60 carbon atoms in a row, to which the 122 hydrogen atoms would be attached.

It has already been said that soaps are made by the interaction of fatty acids and alkali, just as salt is made by the interaction of the inorganic acid known as hydrochloric acid and caustic soda.

It is possible to buy fatty acids for soap making. These are produced from fats by chemical and other means, and are very readily converted into soap. More often, however, soaps are made directly from the organic fats, so that the composition of the fats should be gone into.

Organic fats are mixtures of glycerine and fatty acids, and are known as glycerides. In the making of soap from the fat or glycerides, the fat breaks down into glycerine and free fatty acid, and the fatty acid then combines with the caustic to form the soap. Thus is indirectly fulfilled the fact that a soap is made from free fatty acid and an alkali, just as a salt is made from an inorganic acid and an alkali. The glycerine may remain in the soap or be removed from it. Glycerine is a valuable product and is often recovered in soap manufacture.

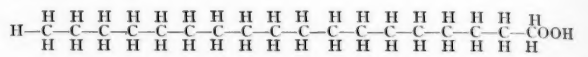
The formula for glycerine is $C_3H_5(OH)_3$, and a molecule of it contains 3 atoms of carbon, 8 atoms of hydrogen and 3 atoms of oxygen, the molecular weight being 3 (12) + 8 (1) + 3 (16), or 92. The chemist pictures it thus:



and you will notice that each carbon has four prongs to which other elements are attached. These prongs—or, as the chemist says, bonds—represent to the chemist that carbon has a valence of four.

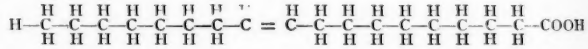
Stearic Acid

We will now consider the formula for stearic acid, one of the most important fatty acids. The formula is $C_{17}H_{35}.COOH$, and is made up of 18 atoms of carbon, 36 atoms of hydrogen and 2 atoms of oxygen, and has a molecular weight of 18 (12) + 36 (1) + 2 (16), or 284. The chemist pictures it thus, each carbon having its valence of four:

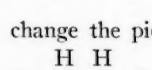


With but few exceptions the formula of all the fatty acids is pictured the same as for stearic acid, the only difference being that the number of carbon atoms and the hydrogen atoms that go with it vary. The chemist calls all the fatty acids which are pictured similar to stearic acid saturated fatty acids, and all their carbon atoms have hydrogen attached to them to make their valence four.

There are a few fatty acids known as unsatiurated fatty acids, and they are pictured slightly different from stearic acid. Oleic acid is an important soap-making fatty acid and has the formula $C_{17}H_{33}.COOH$, and you will notice that the only difference between it and stearic acid is that two atoms of hydrogen are missing, the number of carbon and oxygen atoms being the same in each fatty acid. This is pictured thus:



You will notice that two carbon atoms in the middle of the formula have only one atom of hydrogen attached to each, and that in order to have the carbon have four prongs, bonds or valences the two carbons are represented as being connected by two prongs or bonds instead of one. These two carbon atoms are greedy, and readily pick up hydrogen or other suitable atoms so as to change the picture formula from



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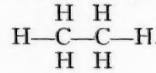
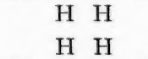


As soon as the formula goes to



the fatty acid is no longer an unsaturated one but a saturated one. Thus oleic acid upon the addition of 2 atoms of hydrogen becomes stearic acid.

Drying Oils and Glycerides

At the present time a new industry is springing up in which unsaturated fats are hydrogenated. It has to do with the adding on of hydrogen to unsaturated fatty acids

(*Continued on page* 666)

Chemical Theory of the Dyeing of Cotton

Amphoteric Properties of Cellulose—Cotton Dyes—The Dyeing Process—Conclusions

By PAUL BARY

(Translated from Revue Generale de Teinture Impression Blanchiment et Appret 5, 847-853, July, 1927, by A. Papineau-Couture.)

AFTER numerous discussions which lasted over a long period, the chemical theory of the dyeing of wool and silk is now quite generally admitted. The work done on albuminoids, chiefly by Soerensen and by Loeb, has shown that these amphoteric bodies actually combine with acids and with bases giving compounds containing more or less acid or base according to the concentration of the acid or basic solution with which they were treated. The reactions brought about in this manner are reversible, and the amount fixed under any given conditions is limited by the law of mass action. If gelatin, for instance, is brought in contact with caustic soda and allowed to reach a state of equilibrium, if the dilution of soda solution is increased the sodium gelatinate is partly decomposed and a new equilibrium is established; if, on the other hand, the concentration of soda is increased a larger proportion of the gelatin present combines with the alkali.

This is a case of a dissociable compound, such as are frequently encountered in chemistry. The application of these reactions in the case of dyeing is rendered all the easier by the fact that it is known that the dyeing of wool by homologous dyes is proportional to the molecular weights of the dyes (Knecht, 1904), and that the dyeing of silk by homologous basic dyes follows the same law (Salvaterra, 1914). It is also known that these reactions can proceed sufficiently far to give characteristic compounds of the albuminoids with the dyes (Holland, 1916).

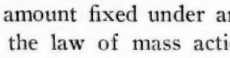
It seems that the dyeing of cotton has been more difficult to fit into this explanation, and as a result of his most interesting work (1917) from which he concluded that dyes combine with silk and cotton, Bader did not seem to consider himself justified in applying his conclusions in the case of cotton, which indeed apparently proceeds in an entirely different manner.

In a treatise on textile fibers at present in press we have given a new theory of the dyeing of cotton, which we now propose to explain.

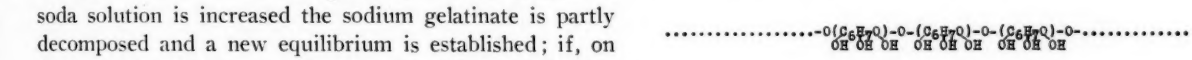
Amphoteric Properties of Cellulose

Cellulose gives two series of compounds: (1) owing to its basic properties it combines with acids to give esters, for which new and important industrial applications are being found; (2) it also reacts as an acid to combine with potash and soda, giving alkali-celluloses of the same chemical nature as hydrocellulose, into which they are easily converted merely by the action of water.

If we consider merely the chemical reactions which occur without destroying its molecular structure and show only the linkings required for its polymerization and esterification, the cellulose unit can be represented as



and the polymerized molecule by the chain

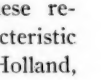


of indefinite length.

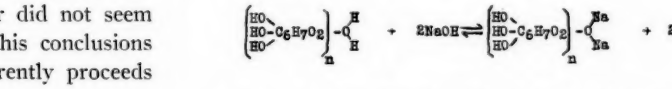
The chain of the cellulose molecule can, therefore, be completed only when the end valences are saturated, such as, for instance, by adding one molecular of water, which gives the compound $(C_6H_{10}O_5)nH_2O$, or

$$HO—(C_6H_{10}O_4)—O—(C_6H_{10}O_4)—\ldots\ldots\ldots\ldots$$
$$\ldots\ldots\ldots\ldots\ldots\ldots—O—(C_6H_{10}O_4)—OH$$

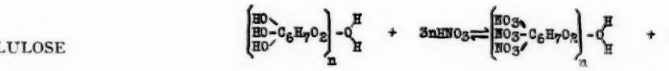
or again



According to this formula two atoms of hydrogen are dissociable in alkaline solution and can be replaced by alkali atoms according to the balanced reaction:



In acid solution, on the other hand (for instance, in nitric acid) having a high hydrogen ion concentration, a reaction of the following type will take place:



These reactions are readily understood if we admit that in aqueous solution cellulose is dissociated, giving

hydrogen and hydroxyl ions, the hydrogen ions being due to the hydrogen atoms at the ends of the chain and the hydroxyl ions coming from the esterifiable groups of the cellulose.

As in all other cases of dissociation, the reaction is governed by the law of mass action, and each kind of ions (hydrogen and hydroxyl) has its own dissociation constant. Hence, in acid solution, that is, when there is a high hydrogen ion concentration, the dissociation of the cellulose will give only few hydrogen ions but a large proportion of hydroxyl ions. As each of these ions carries away a definite electric charge, the remainder of the molecule will carry an equal charge of opposite sign; the electric charge acquired by cellulose in aqueous medium is therefore proportional, but of opposite sign, to the difference in the amount of positive and negative ions to the formation of which it gives rise. In strongly acid solutions, as the hydrogen ion concentration is very high, cellulose will give chiefly hydroxyl ions and will acquire a positive charge; in strongly alkaline solutions, on the contrary, the hydroxyl ion concentration is very high, so that the cellulose will give mainly hydrogen ions and will therefore acquire a negative charge.

There must therefore exist a certain hydrogen ion concentration of the solution corresponding to the iso-electric point of the cellulose; and though no absolute experimental confirmation has yet been given, the work of Larguier des Bancels may be recalled in this connection. On measuring the rate of electro-osmosis through absorbent cotton, he obtained the following results:

Absorbent cotton immersed in—	Sign	Rate
N/2,000 NaOH	Neg.	40
Distilled water	Neg.	30
N/10,000 HCl	Neg.	10
N/200 HCl	Neg.	(?)

The experiments could not be carried out at higher acidities, as the high conductivity acquired by the solution caused a considerable evolution of gas at the electrodes, which interfered with the measurements.

It can be seen from these figures, however, that the negative charge of cellulose decreases rapidly as the hydrogen ion concentration increases, and that it is in the neighborhood of zero in N/200 hydrochloric acid. As it is known that cellulose can be esterified at high acid concentrations, it is permissible to assert that cellulose has an iso-electric point for a given acid concentration, which is fairly high. The ability of cellulose to be hydrolyzed in alkaline or in weakly acid media is due to this fact.

Cotton Dyes

The dyes generally used on cotton, though crystalline, have the common property of dissolving in water to give colloidal solution of a particular type: their electric conductivity is of the same order as that of true salt solutions, and yet when examined through the ultramicroscope and subjected to various other tests they are found to be true colloidal solutions. Such solutions are designated as collo-electrolytic, which clearly indicates this dual property.

The osmotic pressure of solutions of ordinary electrolytes does not increase as rapidly as their concentration, owing to the fact that their dissociation increases with dilution, which causes the ratio of osmotic pressure to concentration to decrease with increasing concentration. In colloidal solutions, on the contrary, the ratio of the osmotic pressure to the concentration increases very rapidly with the concentration, as first known by J. Duclaux and subsequently confirmed by others.

Solutions of the pure cotton dyes are intermediate between crystalloidal and colloidal solutions. The osmotic pressure of dye solutions has been measured by several authors, particularly by Biltz, by Bayliss and by Donnan and Harris, the last-mentioned of whom obtained the following results with Congo red solutions:

Concentration (c) per cent.	1,276	2.617	5.016	6.033
Osmotic pressure (p) in mm.	310	603	1,139	1,363
p/c	243	230	227	226

The almost negligible variation in the value of p/c, which value leads to practically the same molecular weight as required by its structural formula (696), had first of all led to the belief that this dye is neither dissociated nor associated in aqueous solution, as claimed by Biltz and by Donnan and Harris. But this conclusion is inadmissible since the granules are easily observed upon examining the solution through the ultramicroscope.

It was J. Duclaux who first suggested a theory to conciliate these apparently contradictory observations. His explanation was as follows:

If we admit that the dye, in the form of a sodium salt (RNa_2), dissolves in water to give partly a colloidal solution formed of micellas $(RNa_2)n$ and partly a true solution of simple molecules RNa_2, we shall have two simultaneously dissociable systems, and the osmotic pressure of the solution will depend on the number: (1) of undissociated micellas $(RNa_2)n$; (2) of these same micellas dissociated into negative granules and positive sodium ions; (3) of simple undissociated molecules RNa_2; (4) of these same molecules dissociated in negative R ions and positive sodium ions.

On this assumption we can represent the equilibrium of the various constituents of the solution. Suppose that the solution contains T molecules of dye, of which M are in the form of micellas and N $(= T - M)$ in the form of simple molecules, and that a is the dissociation coefficient of the micellas and b that of the simple molecules. We then have $(1 - a)^{\frac{M}{n}}$ undissociated $(RNa)n$

micellas which are in equilibrium, on the one hand with $\frac{aM}{n}$ negative Rn ions + $\frac{2aM}{n}$ positive Na ions, and on the other hand with (1 — b)N simple RNa_2 molecules and the latter in turn are in equilibrium with bN negative R ions + 2bN positive Na ions.

This may be represented by the equation:

$$(1-a)\frac{M}{n}(RNa_2)_n \rightleftharpoons \frac{aM}{n}R_n + \frac{2aM}{n}Na$$

$$(1-b)N(RNa_2) \rightleftharpoons bNR + 2bNNa$$

Now, there is a whole class of dyes which behave in the same way as Congo Red, which was chosen merely as an example, they are the so-called substantive dyes. All these dyes, when in the form of sodium salts, which is the form in which they are usually found, are less soluble in water than the other azo derivatives containing a large number of neutralized sulphonated groups (SO_3Na); and this lower solubility accounts for the possibility of the existence of polymerized molecules in their solutions.

Biltz has shown that by means of the conception of such a heterogeneous constitution of the solutions, the properties of these dyes can find a reasonable explanation and the size of the molecular aggregates can be determined.

In a liquid system containing both simple molecules and molecular aggregates, at each total concentration an equilibrium will be established between the different kinds of molecules at any given temperature, this equilibrium depending on the values of the respective affinities and cohesions of the two kinds of molecules. On raising the temperature the values of these affinities and cohesion are so modified that the solution tends to a greater degree of dispersion, as has been observed in the case of dyes.

The Dyeing of Cotton

Many and varied theories have been brought forward to explain the mechanism of the dyeing of cotton: they can be grouped into a few classes.

There is the adsorption theory, which consists essentially in attributing to all fibers the properties of porous bodies towards solution and to admit that through some inexplicable cause the dyes adhere to the surface of the pores. According to this hypothesis the difference obtained with different fibers and different dyes are due solely to the fact that the specific coefficient of the adsorption formula varies with the nature and condition of the substances used. But where do the chemical properties of the fibers and dyes fit into such a conception? And yet, it is a well-known fact that from a knowledge of these properties it can be predicted whether dyeing will take place or not.

Besides the adsorption theory there is the so-called electric theory, which has found many supporters, at least so far as cotton dyeing is concerned. It possesses the merit of attributing the adsorption of the dissolved dyes by the surface of the fibers to a natural cause, namely, surface electrification, which is a phenomenon which can be observed directly. But the causes which determine the sign of the charge acquired by the contact surfaces have not yet been ascertained.

We have shown above that in the case of cotton (as was already known in the case of wool and silk) it is the hydrogen ion concentration of the bath that regulates the electrolytic dissociation of cellulose, which acquires a negative or positive charge according as it liberates an excess of hydrogen or of hydroxyl ions.

If the dye bath is alkaline or weakly acid, the cellulose dissociates according to the equation:

$$(C_6H_{10}O_5)_nO\overset{H}{\underset{H}{}} \rightleftharpoons \left[(C_6H_{10}O_5)_nO\right]^{--} + 2H^{+} \qquad (a)$$

and the degree of dissociation increases as the hydrogen ion concentration of the bath decreases.

If the acidity is higher than the iso-electric point of cellulose, the cellulose gives off more hydroxyl than hydrogen ions, and its dissociation can be represented by:

$$(C_6H_7O_2)_nH_2O \cdot 3n(OH) \rightleftharpoons \left[(C_6H_7O_2)_nH_2O\right]^{3n+} + 3n(OH)^{-} \qquad (b)$$

The acids of cotton dyes are all quite strong, displacing hydrochloric acid from sodium chloride, and even in some cases sulphuric acid from sodium sulphate.

In the case of reaction (b), that is, in strongly acid solution, the negative color ions are fixed by the positively charged cellulose with formation of water between the hydroxyl ions of the cellulose and the hydrogen ions of the bath. This esterification takes place with all acid dyes, which are by far the most numerous.

In the case of basic colors, reaction (a) must come into play and the hydrogen ion concentration of the bath must then be below the iso-electric point. There is then formed alkali-cellulose, in which the dye acts as alkali.

Is this very simple explanation sufficient to answer the objections generally made to the chemical theory of the dyeing of cotton, the two chief ones being: (1) the non-proportionality to the molecular weights in the cases of dyeing with homologous dyes; (2) the impossibility of completely exhausting the dye bath.

These two facts, which are in contradiction to what takes place in the dyeing of wool and silk, are due to the particular constitution of collo-electrolytic solutions which are explained at the beginning of this article. Substantive dyes, which are soluble in water, are also soluble in cotton in which they give solutions containing color ions of various dimensions while the proportion of simple molecules to molecular aggregates varies according to the temperature, concentration and nature of the medium in which they are dispersed. It therefore follows that the combination of these ions does not seem to take place according to molecular proportions, since in any case the molecular weight of the solid crystalline dye salt is un-

known. At the same time, the variation in the composition of the dye bath according to the concentration prevents its exhaustion beyond a given point, corresponding to the equilibrium point of the reaction.

Conclusions

It follows from what we have just explained that the dyeing of cotton differs from the dyeing of wool or silk in only two respects:

First of all, the amphoterism of cellulose is much more favorable to reactions with acids than with alkalies, which is shown by the fact that the iso-electric point corresponds to a relatively high hydrogen ion concentration.

Secondly, the dyes which can be fixed by cotton nearly all contain many acid groups in their molecules, which makes their solubility in water highly complex, the material existing in all states of dispersion from simple molecules to fairly large molecular aggregates (judging from the size of some of the micellas); all these various stages of dispersion have their own electrolytic dissociation coefficient, which in each case is a function of temperature, concentration, etc.

It is therefore not surprising that in such a complex medium the reactions are not as simple as those which take place between compounds in true electrolytic solution.

Even in the case of the dyeing of protein fibers the nature of the chemical reactions remain ill-defined. In that case the main difficulty in the way of finding a perfectly clear explanation is due to the complex nature of the base on which the dyes are fixed. In the dyeing of cellulose fibers, though the nature of the base is probably somewhat simpler than in the case of protein fibers, it is not yet perfectly understood, but it is known that the simple formulas such as those which we have represented in the early part of the present article are merely incomplete diagrammatical representations and that the true cellulose is composed of several groupings differing slightly from one another. But the greater complexity of the problem is undoubtedly due to the state of the dyes when in solution.

Nevertheless, though these difficulties prevent us from accurately defining the exact nature of the chemical reactions involved because the formula is not definitely known, they cannot be taken as proof that such reactions do not take place. The existence of nitrates, acetates and many other esters of cellulose is a proved fact; it is also known that alkali and hydrocelluloses exist as chemical compounds. We therefore believe that, even though it may not be possible to form a clear conception of the exact manner in which such reactions take place, the possibility of such reactions should not be denied, as they form the only sound basis for discussion, unless some other truly satisfactory explanation of the problem can be offered.

Adsorption, which is all too frequently called upon to explain obscure reactions, certainly does not offer such a satisfactory explanation. It possesses no specific characteristics which indisputably differentiates it from a chemical reaction between polymerized molecules, and it assumes different forms in nearly all the particular cases to which it has been specifically applied.

It therefore seems that until it has been proved that the type of chemical reactions between complex compounds, such as the one which we have just tried to explain, cannot take place, it is absolutely necessary to abide by the notion of a chemical combination.

We hope that we have succeeded in showing that, in the particular case of the phenomenon of dyeing, there is no valid objection to accepting it, even for cotton in the case of which it had not yet been explained.

IMPORTATION OF DYESTUFFS INTO GREAT BRITAIN

Through Trade Commissioner Homer S. Fox of London we have word that the Board of Trade has issued the following announcement regarding the importation of dyestuffs into Great Britain: "An open general license has been issued under the Dyestuffs (Import Regulation) Act, 1920, permitting the importation by sample post as from August 6 of bona fide trade samples, without commercial value, of synthetic organic dyestuffs, colors and coloring matters, subject to the following conditions: (1) The gross weight of each packet must not exceed 8 ounces, and the Post Office Regulations regarding the Imperial and foreign sample post must be strictly complied with, and (2) each packet must bear the full name and address of the consignee; it must be addressed 'care of the Officer of Customs and Excise, Mount Pleasant Depot, General Post Office, London, E. C.'; it must be conspicuously marked with particulars of the contents; and it must bear a statement that the contents are bona fide trade samples and of no commercial value."

FOX TO MAKE TOUR IN UNITED STATES

Great Britain continues to offer a good and steadily increasing market for American chemicals, according to Assistant Commercial Attaché Homer S. Fox, who has spent three years in that country engaged in trade promotion work under the direction of the United States Department of Commerce.

Mr. Fox started a tour through the Southern States the third week in September, and the Department of Commerce reports that he in all probability will make another in some other section of the country the latter part of October.

Mr. Fox's presence in this country affords an opportunity for conferences as to the trade potentiality of the United Kingdom. Those who are enjoying foreign sales in England will probably welcome this visit, whereas manufacturers whose sales are well established might well investigate these export possibilities.

Proceedings of the American Association of Textile Chemists and Colorists

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WINTHROP CARVER DURFEE

We regret to announce that Mr. Durfee, the Treasurer of the American Association of Textile Chemists and Colorists since its inception, passed away on Thursday, September 19, 1929. Funeral services were held at St. John's Episcopal Church, Jamaica Plain, on Sunday, September 22, and interment was made in Pawtucket, R. I.

Winthrop Carver Durfee, one of the eleven children of Walter Chaloner Durfee and Jane Frances (Alden) Durfee, was born in Fall River, Mass., April 23, 1858. His father was a Quaker, a treasurer of a cotton mill and a bank president. Mr. Durfee had always been proud

of his colonial ancestry, and his attractive home in Jamaica Plain is of a dignified type of colonial architecture and typifies this feeling from the front gate to the well-kept garden in the rear.

Mr. Durfee was educated in the public schools of Fall River, and at Brown University, Providence, R. I., where he was a member of the society then known as Chi Phi. After graduating from college in 1878, he worked in his father's cotton mill in Fall River. He has often said that his ability to hang his legs on a bench and talk to his fellow mill hands was very valuable to him. In 1881 he started in business in Boston and was married to Sylvie Whitney, of Pawtucket, R. I., the cousin of his college roommate. He made his home in Jamaica Plain, Mass., where he has resided ever since.

He was for a time a salesman for the St. Denis Dyestuff Company and then for Thomas Leyland Company. This

led to his establishment under his own name as an independent chemist and purchasing agent, advising his friends in the mills as to their needs and securing the wanted supplies including such things as dyewoods, dyes, waxes, dextrin, etc. Practical experience led him to recognize the value of tartrates of certain qualities in wool dyeing. This became the central feature of his business and laboratory, where thousands of dyeings were made to illustrate the action of his tartar products in connection with wool dyeing. No number of experiments was too great for him to undertake to solve a casual question of a prospective customer.

After the beginning of the World War he established a small factory for the making of special mordants for cotton, leather, viscose, real silk, etc., including one or more varieties of the common chromate mordants.

Aside from business he was at one time much interested in the Church Temperance Society and gave much of his time to it. He is a Thirty-second Degree Mason and has studied the history of Masonry as well as that of primitive Greek, Babylonian, and Egyptian religions.

His outstanding characteristics were loyalty to family, college, and associations with which he was connected, his generosity, his patience, foresight, his wide fund of information, and his love of a joke. Mr. Durfee always went to Fall River for his father's and mother's birthdays and had continued the custom ever since his father's death in 1902 and his mother's in 1907, except for his mother's, October 4 of last year, when illness prevented.

He was a member and ex-president of the Drysalters Club, the Engineers Club of Boston, the American Association of Textile Chemists and Colorists, the Boston Art Club, the American Chemical Society, and various other organizations, and councilor of the Northeastern Section of the American Chemical Society since 1919.

When the American Association of Textile Chemists and Colorists was organized in 1921, Mr. Durfee was one of those most interested, and took an active part in its formation. He was elected treasurer at that time, an office which he filled up to the time of his death. He was also a member of the research committee of that association.

Always a prominent figure at the general meetings of the American Chemical Society and the Textile Chemists and Colorists Association, ready to help, not only with his financial support, but with the more valuable assistance of time and hard work, Mr. Durfee won a warm place in the hearts of his fellow workers who knew him most intimately.

LOUIS A. OLNEY.

A FURTHER DISCUSSION OF THE CONSTRUCTION OF THE PIECE DYE KETTLE

A British Viewpoint

[NOTE.—*In the July 17th and 24th issues of the British publication, "The Textile Argus," there appeared a review of the discussion on Piece Dye Kettles, which was led by Harold W. Leitch at the April 6, 1929, meeting of the American Association of Textile Chemists and Colorists, and published in the May 27th issue of the Proceedings. Believing that this will be of interest to many members of the Association, we are reprinting it herewith.*

In view of the fact that the "paper" referred to in "The Textile Argus" was the report of an informal discussion and not a written paper, it is rather interesting to find so litle unfavorable comment and so much agreement. One point that should be given more consideration in reviewing this discussion is that a kettle and its equipment may be well adapted for one type of cloth but unsuitable for others.—H. W. L.]

IT is a most remarkable thing that the dyeing machine, which in various parts of the West Riding, West of England, West of Scotland, and other few places where wool piece dyeing is carried out (and which is known under various names such as the piece dye-beck, cistern, dye-vessel, etc.), varies so much in one works and another. To the superficial observer there may not appear to be a great deal of difference between the various machines, except that some look modern, while others are very decrepit, and must be but mere shadows of their original selves. When one, however goes to the man, the dyer who is dependent for his work on such examples of his tools, we find that he will usually be found to have some very dogmatic ideas as to the construction of these machines. One dyer will say that he needs a sloping back to the machine, while another will equally vehemently declare that he needs a straight back, and thus give an oblong box shape through which his pieces must move. Yet another foreman will state that the best type for dyeing piece goods is to have a curved back for the beck so that the pieces fall gradually from the top of the winch at the back to the bottom of the beck in a gradual manner.

Again, ask different dyers dyeing the same class of material what should be the position of the winch, should it be in the middle over the center of the beck, or a little further back than this, or should it be right away at the back of the machine, or against what height should it be above the liquor, and by asking three dyers it will probably be found that three different replies are given. At times dyers will be found whose views agree, but these differences in opinion are frequently found.

Take again the ideas as to the use of a roller at the front of the beck over which pieces run before they are taken over the winch. There are some really strong opinions frequently vouchsafed on the phase of the construction of a dye-cistern, and they are diametrically opposed.

Volume of Liquor

The volume of liquor is another point where differing views are often stated, although in this case the views given may be tempered by the statement that the volume of liquor to use in a piece dyeing machine depends largely on the type of goods being treated. Every dyer knows that if light weight material is being treated with a large bulk of water in the beck there may be a serious risk of faulty results accruing due to the material floating on the top of the liquor.

If the question of the type of winch to employ is opened out then one meets a regular hornets' nest of opinions and dogmatic assertions, and surely no one is more assertive than the dyer. Should one use a drum? Or should it be a drum with lagged surface? Or perhaps it should be a winch with open lags running across the winch? And yet again what is the best height above the surface of the liquor to place the winch?

And there is still another thorny point of debate about this so simply constructed machine and worked by so many different men for many generations, and that is the question of pegs for separating the pieces as they come out of the liquor; should these be employed, and if so should they be a permanent fixture in front of the machine? The answer to this is that probably most dyers on one class of goods will agree in a fairly general sort of way, but certain classes of material are best treated in machines with movable guides in the form of wood lags or poles stretched from the front to the back of the cistern. Huddersfield coating dyers would probably prefer this type, while some of the lightest types of material might probably be best controlled while running through the machine to allow of varying bulk of material to be treated by means of permanently held bars. In some of the very lightest kinds of wool pieces some machines are constructed in such a way that the whole beck is partitioned in order to guarantee satisfactory running, these partitions allowing the whole liquor of the dye bath to percolate from one part to another by means of suitably made perforations in the partitions. After all, lightly made goods are not very easy to control in the dye beck.

This, then, is the position of opinions on some phases of the construction of this very simple machine, the piece dye cistern, in a part of the world where piece dyeing is undoubtedly carried out more successfully than anywhere else on the face of the earth. Surely in trying to calculate what is really the best type of machine to employ one must come to the conclusion that some opinions are wrong and others are right, and that there *is* a best type to use. It is, of course, true that some machines will give better results with certain types of cloth, while others are more suited to other makes and weights.

American Views

It is therefore with interest that we turn to a discussion of this vital and interesting question before an American audience, and note that in the States also there seems to be a similar problematic set of ideas about the question, as evidenced in the paper by H. W. Leitch in the American Dyestuff Reporter recently.

Apparently some American machines have an overflow arrangement fitted to each dye beck, either at the back of the machine or at the side, which arrangement is quite foreign to English cisterns. The author also apparently prefers the water to be fed in at the front, but in this country an inlet at the back will probably be found more generally accepted.

The ideas used for adding color to the liquor appear to be similar to those used here.

Concerning the stuffing box partition it is stated that the common type is the perforated board or plank (presumably a series of such planks stretched across the machine and making a solid partition from the bottom to within a few inches from the top of the beck but suitably filled with perforations), and here again one would say that this is undoubtedly the usual form of the English stuffing-box partition or baffle, as the Americans "style" it. The author, however, suggests a form of partition which is not generally employed here. This is made of parallel pieces of wood, and these bars are fastened together in various ways. There may be a metal rod running down through them in perhaps three or four places, or they may be fastened with pegs or dowels and supported on pieces of wood. A common baffle of that type would have a space of half an inch between the pieces, and perhaps the bars themselves would be 2-inch to 4-inch thick. This baffle has proved satisfactory for a number of kinds of work, acid dyeing, chrome dyeing and union dyeing.

Winch Construction and Position

Referring to the question of the winch and its position and type, this is stated to be a matter of important discussion. The exact size of the winch depends somewhat on the work being carried out, but is perhaps of minor

importance where there is a whip roller in front. This latter statement that the loosely running roller sometimes placed in front of the winch lessens the importance of the question of the size of the winch would hardly be generally agreed upon among dyers in this country. The question of the roller in front of the winch is in itself a matter of serious debate, and where such is employed it undoubtedly affects the position of the winch and also the size of the winch. If the winch is of small diameter this will affect the drag from the front roller to the top of the winch, and thus both the height of the top of the winch and the distance from the front of the machine are points which will have to be considered here.

The type of reel or front roller is dismissed as a question on which we shall never agree, which is after all surely a very short-sighted state of mind to adopt. To reiterate again an earlier statement there is undoubtedly a right and a wrong sort of winch to adopt, which type will only vary according to the kinds of pieces which are being treated, and while the use of the whip roller may depend on the goods being dyed, such a roller either is or is not of use.

The ideal machine should be so constructed, according to this American writer, that the winch is placed so as to cause the cloth to drop on to the curve at the back of the machine at a point half way on the curve. A guide roller in front of the dye beck is recommended, one advantageous use of this machine being the prevention of splashing from liquor drawn up by the cloth. The point as to the size of the winch being governed to some extent by the use of a front whip roller is, however, scarcely correct, although a big drum-winch may find a front roller more useful.

Speed of Winch

The question of the speed of the winch is, to the writer's mind, a point of the gravest concern. The author states that he has seen machines being worked at different speeds in the same dyehouse with good results at both speeds, but he would select a speed of 60 yards per minute for the average kind of work. His statement that slower speeds may cause cloudy pieces may be correct, but that higher speeds give rise to shaded goods is scarcely acceptable. One of the great enemies of level pieces is slow motion, but for certain classes of goods where too great working or passages over the winch and through the liquor might cause a milling up of the material, then this side of the question has to be considered when speed is being dealt with.

Another phase of dye beck technicalities is the ratio of the volume of liquor to weight of material, a point in wool dyeing which one sees rarely mentioned. The author's suggestion of the ratio of cloth to liquor is of 1 in 20 to 30 (by weight) would probably meet with general agreement in this country, too.

Other points of interest in this important machine are those of the position and construction and position of the steam pipes for raising the temperature of the dye liquors. With respect to the metals parts of the dye beck, we in this country have not a great deal of trouble in connection with this phase of the question, but for certain purposes the various alloys which are satisfactorily resistant to acids used in dyeing are, at times, found to be of great value.

Temperature of Bath

At the meeting at which the above paper was given, some very interesting matters were brought forward, and some of the questions raised are not sufficiently accurately realized, perhaps, as they might be. Concerning the temperature of the liquor at various points of the beck when it is supposed to be boiling it is not always realized the great divergence in temperatures that there frequently is between one part of the liquor and another, and after all it is such points as these which affect such vitally important questions as the variation in shade between one piece and another when dyed together in the same bath. Mr. Leitch points out that a great deal depends, as regards the temperature of the liquor of a dye bath, on the construction of the beck itself; with the perforated board baffle (or stuffing box partition) the temperature at the back of the beck and in the middle would be at least 10 degrees less than at the front. The statement made at the meeting, however, that in some machines recently produced where not enough perforations were employed in the baffle, the temperature at the back would be about 150, and then ranging up to 180 degrees might produce good results, seems to be terrifically incorrect, if dyeing of acid or mordant colors is being carried on. All sorts of faults, quite apart from satisfactory dyeing itself might accrue as a result of such absurdly low temperatures. It was pointed out that with the bar baffle more uniform temperature conditions are obtainable than with a perforated board, which is of much interest.

Viewing this bar baffle arrangement under the difficulties of not having actually used such an arrangement in practice, it does, however, seem to suggest that a great deal of trouble might accrue due to the color getting on to pieces too rapidly and causing unlevel dyeing results. Against this, however, it stated that there is no difficulty with the dye "traveling too fast," and when union dyeing at low temperatures the perforated baffle is very poor because of the great lack of circulation.

When running with steam shut off there is no stirring action in the front of the kettle, or very little. One method of improving circulation is to put in a false bottom. Such an arrangement would probably be new among dyers in the West Riding, but the idea is interesting. This is a solid plank false bottom, with the exception that right in the back there are slots, made by placing three narrow strips there instead of wide planks. This gives a great deal better circulation in the beck. This, along with the steam pipe placed in the beck with the perforations facing up, will give a very good circulation.

Regarding the "fall" of the pieces from the winch on to the back of the cistern one opinion expressed, which also finds favor among many English dyers, is that the goods should fall as far back as possible. There is thus less piling up, and thus less tendency of the piece, as it is folded, to bind against the front, thus causing a lack of motion. The further back it is arranged the more tendency there is for that piece of cloth to avail itself of the volume of the dye bath, and therefore there is greater freedom of movement.

A novel idea put forward is that an uneven diameter reel is a "great thing." Even an oval-shaped one or a triangular reel is helpful. The goods are then folded, and if they are plaited down in folds there is less tendency to bind against the front of the beck.

Regarding the intake of water, the idea is expressed that if the water is run in at the front, which is probably nearest the ideal so far as the proper diffusion of the cold water with the hot liquor is concerned, there is the drawback that it is not economical and requires considerable time for washing off. Perhaps the overflow in the back of the beck might be practical, but if properly applied the washing from the back is as good as any way.

Concerning actual measurements of the machines it should be 8 feet in length and 5½ feet deep. If shorter than this in length, 6 feet in depth is suggested, but 5 feet or 5½ feet in depth is put forward as correct for an 8-foot cistern. As regards the width of the machine from side to side, this all depends on the running.

II

In last week's issue of "The Textile Argus" the construction of the ordinary piece dye beck was discussed and examined as a result of the opinions expressed at a meeting of the American Association of Textile Chemists and Colorists and reported in the AMERICAN DYESTUFF REPORTER. Certain aspects of the question might bear a fuller discussion, and additional opinions expressed may prove to give further value to the matter.

Originating out of an idea given that the depth of the machine should receive greater attention in the construction of the dye beck, it was suggested that the depth of the beck has a great deal to do with the floating of the goods in the liquor, and, further, that goods which are not floated in the beck do not get the proper dyeing conditions. If what is meant by "floating" is the actual floating on the top of the liquor, this is an opinion which would not receive the support of dyers in this country as a good thing for level dyeing. It is not desirable that pieces should float on the surface of the liquor. Actually floating on the surface makes good running of the goods a very difficult matter, and this is the source of pieces getting into knots and getting fast, or forming what are well known in Yorkshire as "buffs." Frequently these "buffs" will mean that the pieces have to be pulled out of the beck for a considerable distance, and the floor in front of the machine is a heap of wet and boiling-hot pieces. Anyone can see that such a state is most undesirable, and if this is found to be necessary shortly after any dyestuff (suitably dissolved) has been added to the bath there is every likelihood of unlevel and streaky pieces resulting.

[NOTE.—*The meaning of "floating," as used in the discussion, is to have enough water so that most of the cloth with the exception of a small pile at the back of the kettle is submerged and not crowded against the baffle or "stuffing box partition," as "The Textile Argus" calls it.—H. W. L.*]

DEPTH OF LIQUOR

The actual depth of the machine, therefore, makes no difference here. To suggest the depth of the machine as the controlling factor here almost indicates that the amount of liquor is a constant factor. What is a far better plan is to have a machine of suitable depth, so that a fair amount of variation of cloth can be worked, and then vary the amount of liquor in the machine according to the material being dyed.

If a very light-weight material is being dyed and the same amount of liquor is employed as would be used for heavier goods, then there is every likelihood of floating of the pieces resulting, with consequent risk of knotting or "buffing" of the pieces at some part or other of the operation, and it is more likely to take place when the pieces are boiling than when getting up to the boil, and when it is in a far more difficult state to put right. For light-weight material, however, it is usual to drop the height of the liquor from the top of the vessel (i. e., use less liquor), and it will be found that the pieces run far more satisfactorily.

Where dyehouses are constantly dyeing light-weight goods it is a frequent practice to have the winches placed at a greater height above the level of the liquor, and in the case of extremely light weights even use partitions

between the different pieces (with suitable perforations in the partitions), so that the liquor circulates to all parts of the machine.

The greatest depth suggested among the ideas given was 5½ feet.

Listed and Shady Goods

With reference to the question of the dyeing of pieces free from listedness, it was also suggested that this might be got over by what the Americans term "tacking" or what is known in this country as "bagging."

The question of listedness is, of course, a most important one, and any mention of the name of "listedness" will instantly arouse the attention of any dyer. It is not perhaps wise to enter too deeply into this question here, since it is such a big one. Listedness can be produced in a dye beck, but to blame the construction of a dye beck is an extremely risky thing to do. The Americans at their meeting brought up a type of cloth where the construction may be something of a contributory character (or again it may not be), but, generally speaking, it is a ten to one change against listedness being caused in the dye beck. Of course, you cannot have listedness unless a piece is dyed, but the listedness is usually there before any dyeing commences, and the dyeing merely indicates its presence. Listedness is the dyer's *bete noir*, and it is absurd to think of the number of times dyers have been blamed for listed pieces which have never been produced by the wildest stretch of imagination by him or his machines, although he is almost the only man who can set about getting them right again.

When, however, you come to goods where there is a liability of them curling, that is the lists curling over, then it is the dyer's duty to see to it that such bad running of his pieces is prevented by bagging, or, as the Americans style it, "tacking," which means sewing the lists together from end to end every few inches. Many goods, however, ought to be better made. In certain cases the type of material cannot be made so that the lists will not curl, but, on the other hand, there are many goods where it is absolutely up to the maker of the cloths to make the lists properly, and many goods which are made with lists liable to curl could very easily be remedied. The result to the maker will also thus be better, for bagging does not always improve the list.

Steam Pipes

Concerning the steam pipes the question was brought forward as regards the type and construction of steam pipes to employ for boiling up the liquor in the machine.

This is also a matter of greatest importance to every dyer. The dyer wants his steam to pass into his liquor so that the whole of the bath is as near the boiling point as ever possible.

From data supplied in the paper given, where it is shown that the temperature of the liquor varies in different parts of the dye beck from, at the front, 210° F. to 203° F. at the back of the beck, it is seen that the dyer may have a great deal of difficulty in insuring, from the construction of the machine and the steam pipes in the machine, an even distribution of temperature.

It is almost impossible in the usual type of dye beck to attain any nearer division of temperature than this, and it will frequently be found that the difference between the temperature at the front and back or any other part of the beck is often much greater than this. It will be quite commonly found that at the back of a large number of becks, when the liquor is supposed to be boiling throughout, the temperature rarely gets above 195° F. when the pieces are running in the machine. A more even distribution of heat and nearer to the boil all round would get over a great amount of faults and difficulties which arise.

One suggestion which might interest many dyers is to have a pipe made in the shape of an inverted "T" running into the center of the stuffing box, with the pipe and "T" joints of 2-inch width, but at each end of the inverted "T" the pipe is converted into a ¼-inch pipe. This is said to give good results. If such an arrangement can keep the liquor boiling it might mean a saving in steam (what a wastage in steam there is in dye becks!) and would prove of great value.

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Silk Weighting and Percentages

The War Cry of Overweighting—Expressing the Amount of Weighting—Finish Percentages—Overweighting

By J. J. Reutlinger

THE world at large, particularly the silk producing countries, has taken an intensely keen interest in the problems confronting the silk manufacturers.

Silk never was sold at prices prevailing to-day, when compared with the actual purchasing value of the dollar. Silk, silk dresses, and all silken things in general, were never as popular as they are at the present time, and still manufacturers of silk do not seem to prosper and cash in on the tremendous volumes of yardage which are being consumed annually in this country. The business rather seems to be stagnant. Solutions to this economic problem have been offered and have been broadcast from time to time, without affecting the market in the slightest degree.

Cries of over-production and under-valuation are constantly heard, and hand in hand with it goes the story of weighting. To the younger generations of silk manufacturers, to the younger generation in general, the war cry of overweighting, which is sounded throughout the nation, sponsored by leading consumers' organizations and backed up by the manufacturers of the old school, takes on the aspect of a dark cloud, ready to burst, and still the weighting limits are raised and raised from year to year. Will this menacingly dark cloud surrounding us burst wide open and cause a calamity unforeseen in the silk business? Hardly, provided steps are undertaken to disperse this threatening cloud, and steps are being taken by the leading trade associations to break up the dangerous situation and to bring relief to a business, which is in dire need.

Independently from existing committees elected by trade associations for a solution of the problems, the U. S. Bureau of Home Economics, in behalf of the American Home Economics League, a consumer's league recently requested the American Standards Association to call a conference to discuss the possibilities of conveying to the consumer (the housewife) just what amount of weighting is contained in a piece of silk. "Whether it would be desirable to take steps to establish uniform and recognized practices in the labeling of silk to show the amount of weighting and finish, etc., in a piece of silk," and among other questions, "whether the time is ripe to provide for the establishment of nationally recognized standard methods for conducting laboratory tests to determine the amount of weighting and finish" and "to establish a formula to express the percentage of weighting in silk" which everybody concerned can understand.

The result of this meeting is referred to on another page of this issue, but the writer, who has had considerable experience with questions of weighting arising in the retail field, cannot help but say that unless the weighting question in itself as to the proper limits is solved, all other questions and efforts to establish standards are of no consequence, as they are secondary to the main issue on weighting, and to bring them up at the present time is premature.

On the other hand, it may be argued that we are in the midst of the problem, and such steps would be in line. There is no doubt about it, the problem confronts us right now, we are in the center of the agitation and steps must be taken to solve the problem.

The Amount of Weighting

In considering weighting and the method of expressing the amount of weighting there seems to be some difficulty, and retailers do not agree with the expressions used by the producers of weighted silk, which is a rather doubtful way of expressing the percentage of weighting for the layman, but which has merits of its own and has as its foundation certain rules established by our forbears, who have been past masters at weighting less than thirty years ago and who have laid out definite rules for an easy check-up of the weighting implanted into the threads of fabric. This rule has been inherited by the younger generation of manufacturers and has become a trade practice, which will be hard to uproot, but could be easily suspended with since piece-dyed fabrics are causing the controversy and come particularly into question to-day.

Weighting percentages as used by the trade to-day are based on the excess weight delivered by the dyer over the weight of the woven raw or grege goods. If, for instance, 100 pounds of silk are delivered to the dyer and 140 pounds of dyed fabric is returned, the weighting would be expressed as 40 pounds overweight, or 40% weighting.

The reason of expressing the weighting in this manner is obvious, and is traced back to the weighting uses of the yarn-dyed period, where the manufacturer counted the skeins, then weighted them and sent them to the dyer. He instructed the dyer and weighter to return to him the same number of skeins, but for every pound or 16 ounces he sent he wanted a certain weight back which he expressed in ounces of the total weight returned. So, for instance, on a weighting of 22/24 ounces he expected his original pound of silk to be returned to him weighing between 22 and 24 ounces. It was then an easy matter to check back on the weighting received, and the manufacturer had an easy control system. The matter of gum removal or boil-off was not considered at all, and a question of whether this percentage or that percentage is better to express, did not come up at all.

It is to be granted that the consumer at that time did not take the acute interest in the situation as he does to-day, and since the public is interested in this matter it might be wise to let them in on it and revise the meth-

ods no longer of any consequence to the trade and revise them in a way that is easily understandable to him. It is thus to be said, that the public is making use of its education and wants to know what is what and who is who. The public pays and buys the silk and nobody can deny them the right to be on the lookout and to desire to know what they buy, before they buy. The "public be d——" policy does not go any more, and the changes which have taken place in the past decade have all been radical. Only the last few years have brought out buying by construction, while before constructions were a closely guarded secret, meaning the life or death of a silk manufacturing firm. What was held to be of vital secrecy to a silk manufacturer is being played football with today, and still the loomage has been steadily increased in this country.

The same thing will happen with weighting. Closely guarded percentages, which meant advantages over a competitor, will very shortly be a thing of the past, and are going to be common property, and by becoming common knowledge the evil of overweighting will be curbed and safe margins will be established and will be adhered to by everybody in the business, and everybody will see the black threatening cloud pass by.

The retailer, and in line with him the consumer, will demand a change of expression of the weighting percentages, not based on the old adhered-to methods, but of a new one, expressed in percentage of the actual weight of a finished sample, or based on a 100% content of the silk, which means that a sample contains, for instance, 80% silk and 80% weighting, the 20% being either all or in part metallic weighting.

Requests by retail organizations made to existing textile laboratories to express weighting in all possible forms include the giving of the results as follows:

Commercial Weighting—In percentage as expressed by manufacturer and dyer, or based on the raw weight as par.

Actual Weighting—In percentage as expressed by an 80% par on the original raw weight or taking into consideration a 20% boil-off loss or based on the boil-off value of silk as par.

One Hundred Per Cent Content—In percentage of the total weight as found in the finished sample.

This latter method is for the consumer the easiest to understand, as it does away with technicalities or silk problems as encountered by the manufacturer, but it has a disadvantage which might cause uneasiness and dissatisfaction, unless the percentage is given on a bone dry base, which again would not conform to the finished material as a consumer would ultimately buy it. The hygroscopic quality of the silk on the other hand would tend to show differences in percentages if based on actual content as found.

Another source of dissatisfaction of the present system of expressing weighting, as well as on expressing it on the 100% content base, is the fact that not all weighting is metallic and that dyestuffs are increasing the weight of a fabric often up to 10% as in the case of blacks. The employment of finishes, water soluble and others will often bear on testing results, and unless taken care of will materially change results of the expressed percentage.

The inclusion of all these factors in a test requires considerable chemical research, inasmuch as finishing formulas are secrets of the dyers and play an important phase of converting and consequently would place testing on such a base outside of the limits of the average purse.

It is then highly problematical whether test results, based on chemical tests only, would show positive results, inasmuch as the chemical reaction on the unknown finish could not be ascertained. This factor will crop up continuously in a testing laboratory, and must be taken into consideration when expressing weighting in percentage based on any method, and a test is not a 100% proof if not counter checked by a calculation of the actual silk content, based on a construction analysis of the fabric in question. The average laboratory is not in a position to check back by way of construction, which requires expert knowledge of manufacturing and reconstructng of a sample to be tested on a loom base.

The only possible alternative for the consumer to have his way of expressing weighting would be to express the total of metallic weighting content, based on the actual fabric as it is, including finish and moisture content, without reference to the actual amount of silk or other substances contained in the fabric, and this again would be unsatisfactory, as the amount of finish of non-metallic origin could be manipulated, and dissatisfaction in another direction would be the result.

Finish Percentages

If the queston of tin weighting is going to be taken in hand by retail or consumer leagues, the question of finish percentages or adulterations through other substances than metallic salts should be considered at the same time, otherwise one evil will just replace another one. The weighting question is an acute one at the present time. and is actively investigated by the various factions directly concerned.

Overweighting

What constitutes overweighting and the safe limits of weighting is of more importance than all other questions, whether it is 20% or 60%. Tests made by the writer have convinced him conclusively that it depends entirely on the construction of a fabric and the physical composition of its inherent parts, which will determine the absorption and effect of weighting in a fabric. A

fabric may, for instance, be weighted 40%, the warp in this fabric being raw silk, which shows an absorption of 60% weighting, while the filling (crepe) shows only a 25% weighting content. The warp, invariably, regardless of its heavy loading, will test up in tensile strength as far superior than the lightly weighted filling, which again proves that it depends on the character of the construction whether a piece of silk is loaded just right or whether it is overweighted. To set up standards is the most difficult task ever undertaken, as a good many other factors enter into the picture, as quality of the silk used in the original construction, etc.

Weighting of piece dyed fabrics to bring back the loss of gum is beneficial to a fabric, but above that point it constitutes adulteration and could be dispensed with in the average silk fabric, and silk would reign once more in its old domain as "Queen of Fabrics."—*Silk.*

The Matchings of Rayons With Vat Dyes

WHILE we are able to manipulate artificial silks (generally speaking) in a satisfactory manner nowadays, we probably realize more than ever that we cannot exactly regard the various rayons on the market as merely a kind of cotton material. We know that there is a vast amount of difference between the treatment required in dyeing artificial silk and cotton or any of the older fibers of commerce. Indeed, one can certainly say in some respects we are a long way off the thorough understanding of the very best treatments to be given to the artificial silks in order to obtain the exact results which we expect and require. The fact that in a chemical sense the artificial silks (excluding acetate) are merely cellulose in a greater or less degree of purity does not help us sufficiently in our mechanical manipulation during dyeing and other processing. There is no doubt that extra care is undoubtedly required, and special experience needed in the dyeing of the artificial silks, especially in the yarn states.

Hanks should be treated over sticks in the open dye becks, preferably using bamboo sticks or glass rods, the glass holding the hanks and the bamboo stick being used for turning them.

The proportion of volume of liquor to the amount of material is generally 30 to 1.

When using the vat dyes the reduction of the color is carried out in the usual way.

Dyeing should, however, be done at as low a temperature as is needed for the results required, and additions of such assistants as salt and Glauber salt should be avoided, since the higher the amount of salt present the greater is the risk of producing unlevel dyeing.

The amount of caustic required should be the same as is usually employed for the dyes used, but the addition of Turkey Red oil or other suitable wetting-out agent should not be omitted.

Such agents are most important, especially when it is borne in mind that viscose in particular has a great affinity for vat dyestuffs, and improved penetration is thereby secured.

Dyeing may be best carried out at low temperatures, but this is not always possible.

In matching to a given pattern, it should be remembered that too long a time must not be taken in doing this or the material may suffer, due to giving too prolonged a manipulation of the material. In certain cases it may be possible to obtain a good idea of the exact amounts required from previous bulk matchings or from laboratory dyeings carried out on the same material, although perhaps nothing more than a guide may be obtainable in the case of the "lab" dyeings, due to bulk work not always being obtained in accordance with small samples experience.

In producing deep shades it may be better to add the color in two or three successive lots rather than all at the start of the dyeing.

In applying the vat dyestuffs three color phases come under consideration. Firstly, there is the color of the alkaline solution of the leuco-derivative of the dye; secondly, the color of the material at the end of the dyeing operation, and, lastly, the color of the material after soaping. Each feature is characteristic of each member of the vat series. With experience any differences would be noticed, but these variations would not be obvious to those not thoroughly acquainted with the phenomena indicated by each color. Even the foam on the surface of the liquor indicates the condition as to whether it is as it should be. As soon as the vatted solution is found to be in its normal condition, the dyeing may be started at a low temperature, about 20° C., by working carefully for half an hour, when a small portion is taken out from a hank and given the necessary treatment ready for examination.

In the meantime the material is lifted from the dyebath and hung on rods in such a way as to provide equal exposure to the air.

If the shade is not exactly as required the whole is returned to the bath after raising the temperature or making an addition of salt. With experience the matching to sample with vat dyes becomes a matter of ordinary difficulty only.

After dyeing the yarn is hung up to allow oxidation of the color to take place, given a wash-off with warm water, and then scoured with dilute sulphuric acid. Then wash off the material twice with cold water, once with hot, and subsequently soaped at from 50° to 70° C.

Drying of the material is best accomplished in the air at the ordinary temperature when time and space permit. Where artificial heat has to be employed (which is generally the case), the temperature should not be allowed to rise above 60° C.—*Leipziger Monatschrift fuer Textil-Industrie.*

PATENT AND PROCESS NAMES AS SPECIFICATIONS

By Waldon Fawcett

THERE is cause for satisfaction in any development in law or in trade practice which operates to lessen the confusion which has existed regarding the generic quality of invention names or process names. Accordingly, significance is attached to the recent incident which brought Federal recognition of the distinction to be drawn between the patent name of a machine and the trade name of the products of the machine. That the episode has occurred in a quarter within hail of the entire textile industry renders it all the more illuminating.

The status in industry of patent and process names is important to the trade community because of the custom of making use of this type of designation for purposes of specification. If not in the early stages of an invention or evolution, almost certainly at a later date buyers will form the habit of ordering by the familiar patent or process name, using it as a common noun and spelling the term in lower case, even though it may have originally been put in quotations and been spelled with a capital letter. That something of the same appropriation may take place in the case of coined trade-mark names has been attested by the examples of Kodak, Vaseline, Celluloid, etc.

If they have given any thought at all to the matter, traders have doubtless been easy of mind with respect to usurpation of patent and process names because of the assumption that sooner or later all such names become common property. It is well understood that upon the expiration of a patent the invention falls into the public domain. If the inventor or patent owner has provided the public with no means, other than the patent or process name, of indicating or identifying the subject of invention, the notation is accounted descriptive and is opened, along with the patent privileges, to the free use of all.

The interesting phases of the employment of patent and process names as specifications are to be found, not in the workings of the traditional system, as above outlined, but in the exceptions to or modifications of the rule. One of these calculated to establish a precedent is the current "Knitted Padding" case. It draws a distinction most clearly between the patented facilities of production and the translated result of mechanical ingenuity. The result may be of rather more than passing interest in the textile field where it is by no means unusual for the name of the producing machine or an indication of the creative process to be embodied in every-day specification.

The Knitted Padding Case

This test of what is generic in textile names was precipitated when the Pittsburgh Waterproof Company filed, at the U. S. Patent Offce, a petition for the cancellation of a trade-mark registration standing in the name of the Knitted Padding Company of Massachusetts. The mark which it was thus sought to have vacated consists of the term "Knitted Padding." This brand name is used on a product consisting of unspun cotton fiber made into sheet or blanket form, reinforced and held compact by stitching. Ordinarily, a term so obviously descriptive as "Knitted Padding" would never have been granted registration as a trade-mark. But this particular phrase has been in use as a trade-mark since the year 1880 and consequently was admitted to the register under what is known as the Ten-Year Clause, which grants a special concession to trade-marks that were continuously and exclusively employed by one user for at least ten years prior to 1905.

In asking that its competitor be deprived of trade-mark credentials the Pittsburgh company claimed that the words "Knitted Padding" had never been used as a trade-mark but only as the generic name of the goods. In support of the plea that the term is generic, the attacker cited three different patents. The first of these was issued to Matthew Townsend in the year 1879. The second patent, as of date of 1898, covers an attachment for knitting machines, "more especially such looms as are adapted to make knitted paddings." The third patent, issued in 1915, covers a stop device designed for use "with the general type of knitting machine for producing knitted padding."

The Pittsburgh Waterproof Company joined issue in this matter of patent names, not because of broad interest in the controversial question, but by reason of the fact that in its operations in manufacturing knitted construction padding or knitted fabric, it was threatened with suit by the Knitted Padding Company for trade-mark infringement. The officials of the Pittsburgh Company argued that in the case of a new article like knitted padding, or an article manufactured under a patent, the name does not become descriptive for the first time upon expiration of the patent, but became descriptive when it was first applied to the article.

Names Not Public Property

This was in line with the principle that is firmly established, viz., that in the case of a patented article the name is not open to public use because the patentee, while the patent exists, is the only one who can make the article and hence is the only one using the name. When the patent expires others for the first time have the right to make the article, and having the right to make the article have the right to describe it. From that springs the theory that it is not at this late date that the name takes on descriptiveness. The contention is that it has always been descriptive because it is the name of a new thing. And that whereas during the existence of the patent it was descriptive only of one man's goods, upon expiration of the patent it became descriptive of the goods of everyone who chooses to exercise the right to make the article.

Knitted Padding Company vigorously challenged the

doctrine that "Knitted Padding" was the name of a patented article. It was conceded that the Massachusetts corporation or its predecessor had owned patents, now expired, for a knitting machine and improvements, upon which was made the fabric indicated by the name. But it was emphasized that these are *machine* patents, and it was denied that the material or fabric was ever a patented invention. Indeed, not only was attention directed to the fact that the particular patents involved are, upon their face and by their claims, machine patents, but it was brought out that the Townsend patent actually disclaims the product of the machine.

Accepting the reasoning of the Knitted Padding Company, the United States Examiner of Interferences refused to cancel the registration of "Knitted Padding" as a trade-mark. The case was, thereupon, appealed to the Commissioner of Patents. That official was unable to find any evidence that during the life of the original patent, which expired in 1896, the name "Knitted Padding" had ever been applied to the article manufactured. Accordingly he held that the Pittsburgh Company had not fulfilled its responsibility to prove that the product name was a generic term, and cancellation was refused.

By splitting hairs, as it does, in the matter of patent names, the outcome of the contest over "Knitted Padding" serves notice that the traditional precedent, the historic case of the Singer Manufacturing Company, is not to be accepted as an infallible guide to the status of patent names. The essence of the Singer doctrine is that a patent name becomes generic when it comes to indicate the invention. Not only was "Knitted Padding" shown to be something apart from the patented machines with which the term might be associated in a descriptive sense, but it was demonstrated that the fabric can be made on machines others than those covered by the cited patents. Or, for that matter, the goods might be made by hand. Broadly speaking, the "Knitted Padding" case indicates even more clearly than its partial parallel, the President Suspender case, that Federal censors will not assume that, of necessity, every name associated with an invention is perforce generic, nor will concede without proof of fact that every name used on a patented article passes to the public on the expiration of the patent.

ANNOUNCEMENT IS MADE OF NEW ENGLISH DYEING MACHINE

A new dyeing machine which is based on the so-called Hammond system has been announced by the Submerged Combustion, Ltd., of London. It is reputed that this machine assures a fine uniformity of dyeing and that there is no subjection to any form of friction. The machine is supposed to eliminate dilution of dye liquor strength, and the company claims that material comes out of the dyeing process uniform in shape, and that any nap which the material may contain is unimpaired.

THE DEVELOPMENT OF SIZING TECHNIQUE

WRITING in the current issue of the "Artificial Silk (Rayon) World" a contributor says:

"For many years sizing has been regarded in rather a secretive light, and it is only of comparatively recent date that the details of machine construction and design have been freely disclosed. This step, however, has been rendered more or less essential in view of artificial silk's rapidly extending utilization. Initially, rayon employed as warp was, in general, a two-fold yarn, the luster and important feature "fullness" being consequently very appreciably reduced. Subsequent developments in the yarn structure produced a multi-filament yarn of superior strength, with good wearing power and a greatly enhanced luster. In this form the greater proportion of rayon is employed by the manufacturer to-day.

"In weaving, however, considerable difficulty was experienced at first with the filament structure, and this became all the more accentuated when comparison was made with the folded yarn previously employed. It was found necessary to introduce a process whereby the filaments could be worked into a form more solid and firmer, so that weaving would be effected with a greater degree of efficiency and with a minimum of cut filaments. The necessity for this process of sizing will be more easily understood when it is remembered that relative to cotton the rayon yarn is practically devoid of twist. Although the synonymous term "sizing" is applied to both cotton and rayon yarns, the nature of the operation in the latter instance differs from that applied to cotton.

"Within the past five years much attention has been devoted to the sizing of rayon, for, apart from the rapid development of the industry, the question of loom efficiency has been involved. At the outset, the weaving of the filament structure in warp form created a relatively low loom efficiency and was the cause of much trouble and anxiety to both weaver and manufacturer. A few firms, however, made a special study not only of the process but also of the industry, and the main difficulties have been overcome. The progress made in artificial silk sizing has permitted extensive developments in fabric design and production and has had a considerable influence on the recent expansion of the industry.

"The increasing popularity of fine filament and denier yarns, the weaving of which involves a greater degree of skill, for example, is really due to an efficient sizing system."

RELATION OF SCENT TO SALE

Word has been received from Donald A. Laird, director of the Colgate University Psychological Laboratory at Hamilton, N. Y., that work is being done in experimentation as to which type of scent is most suitable for boosting the sales of various types of products. This should be of considerable interest to members of the textile trade.

ROBINSON APPOINTED MANAGER OF DU PONT DYESTUFFS

E. G. Robinson has been named general manager of the Dyestuffs Department of E. I. Du Pont de Nemours & Co., succeeding W. F. Harrington, who was recently elected a member of the executive committee. Mr. Robinson had been assistant general manager of the Dyestuffs Department and has had long experience with the Du Pont Company.

Cesare Protto has been appointed assistant general manager of the Dyestuffs Department to succeed Mr. Robinson. He is a graduate of the Scuola Professionale of Biella, Italy. He is a chemist by profession and had been a technical expert in the dye industry of this country for many years. He also had experience in the dyestuff manufacturing industry abroad. He had been with the Du Pont Company since 1917, beginning in the Development Department and becoming a specialist in the Dyestuffs Department of the company when this was formed. He was successively manager of the Technical Division of that department, assistant director of sales and finally director, which position he held until his appointment as assistant general manager of the company.

LA FOLLETTE DEMANDS TEXTILE INQUIRY

Senator Robert La Follette of Wisconsin, Chairman of the Senate Committee on Manufactures, made the announcement recently that he would use his influence to secure the approval at the earliest possible date of the resolution (S. Res. 49) for the joint investigation of the textile industry by the Federal Trade and Tariff Commission.

The resolution whose adoption is so fostered is as follows:

"Resolved, That in order to afford the Senate information as a basis for determining what legislation, if any, is advisable with respect to the matters specified in the preamble of this resolution, the Federal Trade Commission and the Tariff Commission are directed to ascertain, first the facts throughout the United States with respect to the matters so specified; and, second, whether such facts show the existence of unfair methods of competition in interstate commerce or violations of the antitrust laws with respect to the textile industry, or show the existence of inequalities in the protection afforded by the tariff laws to the textile industry, including the employees thereof, in the various sections of the United States. . . ."

James Worton, who for the past seven years has served as an instructor of dyeing at Durfee Textile School, Fall River, Mass., has accepted appointment to a similar position with the National Association Institute of Dyeing and Cleaning, Inc., in Silver Springs, Md.

EXTRACTORIALS

Research has for its purpose the finding of facts with respect to any activity. It eliminates hunch, clairvoyance, opinion, intuition, fallacies—things that you want to believe but aren't so—things you see that aren't there. Research has come into business problems simply because there are so many fallacies in these problems at the present time that we've got to get down to bedrock to ascertain the truth.—*E. St. Elmo Lewis.*

Perhaps there are times when every man looks back to the period when his business was smaller than it is now, and he thinks that if he could only go back to those days how easy it would be to solve the problems. He forgets that when his business was smaller these problems were as great to him as are the larger ones that he encounters to-day. And the men who have made the greatest successes in the business, as well as those who will do so in the future, are the men who grapple with energy and determination with the larger problems which arise, one after another, as the businesses with which they are associated continue to develop.—*The Starchroom Laundry Journal.*

Whether men work with their hands or with their heads, or both, they have found from time immemorial some good in organization. The crafts, the guilds, the trade unions, all have played their part. Ideas in respect to the knowledge required and the skill necessary for qualification develop with the progress of science and art; and it is only through organization of the members of the profession that the opinions of those concerned can be ascertained.—*Canadian Chemistry and Metallurgy.*

From the Pacific Coast comes news of a gain in the sales of cotton goods and much talk of bright colors. It remains to be seen whether the Pacific Coast laundries are to be congratulated or sympathized with. It all depends on the dyes.—*Laundry Standard.*

The big boss has no more important duty than to study the individuals in his organization with a view of recognizing talent as it develops, directing and fitting it to carry a larger and larger load in the most efficient manner. This type of individual is usually eager for responsibility, and it should be given to him as fast as he can carry it successfully.—*Harrisburg Bulletin.*

It is most gratifying for one in any way connected with laundries to see advertisement after advertisement in the pages of various trade journals featuring vat dyes—the panacea for laundry ills.—*The Laundry Standard.*

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
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WHY NOT MORE SHADE CARDS?

"THERE is tremendous competition in selling dyes to-day." But that, you may say, is nothing new. There has always been competition, if not among domestic manufacturers, then between the domestic and the foreign dye industries.

Such competition usually implies as a consequence a difficulty in making sufficient profit on dyes to pay for the great cost of developing, producing and selling them. There is no doubt some manufacturers have overcome this difficulty by reducing their costs of production or by saving on raw materials through skillful buying of crudes, or by good merchandising methods. Many of our dye plants could not exist were it not for their ceaseless endeavors to increase profits by one means or another without raising prices.

American dye manufacturers have succeeded in attaining quantity production at low cost in many classes of colors. Their prices show their success in this direction. Their plant management must be excellent, else they could not afford to reduce prices from one year to another. But many manufacturers may still learn a thing or two from the Germans and the Swiss about selling methods.

One of the reasons German manufacturers win markets for their dyes all over the world is without doubt their skill in *selling* their products. This quality is displayed very specifically, we believe, in the great number of shade cards issued by the German and Swiss industries regularly, month after month. It is excellent advertising, especially when supported by trade paper advertising which calls attention to new shade cards, offering to send copies on request.

There is a lack of enterprise displayed by many American manufacturers in their failure to advertise their products by means of more shade cards, mailing circulars or books containing dyed swatches. These cards usually go straight to the laboratories of the mills and are studied by the dyer in charge and later filed for reference. They supply information on various series of colors and new additions that is extremely valuable to dyers, and we should not like to think that American manufacturers are slow in perceiving the sales power of such literature.

Yet, judging solely by the shade cards and similar advertising matter received at the editorial desk of the REPORTER, there are at least ten printed in Germany or Switzerland to every one issued by an American firm. More shade cards and more attractive sales literature may be one answer to the urgent problem of increasing profits in the dystuff business.

DYE DUTIES AND THAT FLEXIBLE TARIFF

THE wordy battle in the Senate last week over the flexible provision threw an interesting light upon the process of tariff making. It offered further evidence of the fact that the predominating character of this process is *uncertainty*. The whole tariff, indeed, is a very flexible thing while the Senate has hands upon it, and there is not an industry in the country can rest assured that the question of its protection has been definitely settled. Not until the tariff becomes a law can anyone feel this assurance.

But since there is no remedy for all this uncertainty, no point is to be gained by making a fuss over it. The best any industry can do is to keep its tariff eye wide open. Especially during this flare of debate over the flexible tariff and other administrative provisions, our dye manufacturers and the textile industry can do nothing wiser than to study closely each day's developments.

So far, the American dye industry has had little to complain about from the treatment it has received at the hands of the tariff-making committees of Congress. Three points have been won—though won strictly in a negative sense—while only one loss has been sustained. In the version of the tariff framed by the House and revised by the Senate Finance Committee, the three points favoring dyestuff protection have been, first, retention of American selling price as the basis of valuation; second, retention of the same ad valorem and specific rates on dyestuffs that are now in operation in the 1922 law, with an exception to be noted presently; third, the extension to the dye paragraphs of the privilege accorded by the flexible provision, which was achieved when the clause that denied these privileges was stricken from paragraphs 27 and 28 by the House Ways and Means Committee. The one loss sustained is the exception in rates alluded to: a sharp reduction in the duty on Indigo and Sulphur Black from 45 per cent to 20 per cent ad valorem, from 7 cents per pound to 3 cents per pound specific. This was the work of the Senate Committee

Now the issue has arisen in the Senate, shall the flexible provision be retained in the new tariff, or eliminated; and if retained, upon what basis?

For a while, therefore, the dye industry—not to mention many another industry—will face the possibility of losing another point, a protective advantage which was conferred upon it only a few months ago by the House, and one that might become in the next few years extremely valuable. Flexibility in the rates of duty on dyes will always be a very precious asset to our industry. Few other industries undergo such rapid changes as the chemical industry. Few other American industries have for a rival in world trade a race of giants like those which have sprung from the soil of the European chemical industry. What prophet can declare that the rates on dyes embodied in the pending tariff act will suffice twelve months hence? Who can assure us that the reduction in duty on Indigo and Sulphur Black will not eventually prove to be an opening wedge that will threaten the welfare of our dye industry?

President's Hoover's statement in favor of the flexible provision, issued last Tuesday, was timed to strike the ears of the Senators at precisely that moment when they were considering resolutions on the issue submitted by two of their members, Simmons, of North Carolina, and Smoot, chairman of the Finance Committee.

The President was outspoken in his advocacy of the flexible measure. He reminded the Senate of his views on this provision which that body heard in the course of his message to Congress in April, when the special session convened. At that time the President was impelled to speak on the broad principles which are of importance in tariff legislation, and as one principle he named the flexible provision. Last week he made it very plain that this provision was far too important to our country's welfare to strike it out of the Hawley-Smoot bill. One of the stock arguments against it is the charge that it grants dangerous power to the President. But Mr. Hoover maintained that under the flexible feature the President has no authority to initiate changes in the tariff; no power rests on him until after the recommendations by the Tariff Commission. He said further:

> The flexible provision is one of the most progressive steps taken in tariff making in all our history. It is entirely wrong that there shall be no remedy to isolated cases of injustice that may arise through the failure to adequately protect certain industries or to destroy the opportunity to revise duties which may prove higher than necessary to protect some industries. . . .

The Senate was, we have said, about to engage in debate over the flexible provision when the President's statement broke upon them. The fact is that Senator Simmons, Democrat from North Carolina, had introduced a resolution to strike out of the tariff this provision. That Mr. Hoover was impelled to utter his views because of this Senator's move is very likely.

This flexible tariff issue is, of course, nothing new. It was under heavy fire when first written into the 1922 Tariff Act. But in the present instance it has won some notable defenders. John E. Edgerton, well-known president of the National Association of Manufacturers, appeared before the Senate Finance Committee in July to declare that:

> The economic necessity for flexibiilty in rate adjustment rests upon the incontrovertible fact that we live in a period of rapid industrial change. The discoveries and applications of science, the march of invention, improvements in processes, organization and administrative methods, and the fluctuation of foreign policy, all make it necessary that a means of limited adjustment shall be at the service of the American producer. . . .

This opinion is peculiarly significant to us because Mr. Edgerton's allusion to "the discoveries of science, the march of invention" might almost have been made with the chemical industry in mind. Following him came James A. Emery of Washington, who was equally spirited in defense of tariff rates that can be changed to meet the shifting conditions. He said to the Senate Committee:

> It merely undertakes to provide our own country with machinery for protective administrative rate adjustment, equal in efficiency to that possessed and operated by our chief foreign competitors.

The Simmons attack last week was not the only move made by the Senate in its scrutiny of the flexible provision. Senator Smoot also introduced a resolution which by vote was brought before the Senate ahead of Mr. Simmons' drastic measure. Smoot, who is an author of the tariff and chairman of that Senate Finance Committee which revised the House bill, would by all means retain the flexible feature, with certain changes. In a speech last Tuesday he warmly defended the flexible tariff and explained his suggested changes. Part of his defense will bear repetition here because it supports the opinion already quoted:

> Congress cannot prevent, nor should it shut its eyes to, economic and scientific development. But the Congress can and should preserve and perfect a tariff system that is adaptable to meeting these developments in so far as they affect the relations between our domestic agricultural and manufacturing industry and its foreign competitors. Not to do so is a counsel of retrogression.

As the situation stands, consequently Senator Smoot sides with the President against Simmons, LaFollette and their group, against the idea of striking out the flexible feature.

But let us see how Mr. Smoot would change this

provision. First he wishes to make it clear that the President, in raising or lowering rates under the flexible ruling, must base his changes upon the investigations of the Tariff Commission. This, certainly, is no more than fair. Next he would include a definition of transportation costs—a point rather too technical to discuss in detail at this time, but a point clearly affecting the *difference in cost of production* between American and foreign merchandise, which makes the Senator's third change. For it is upon this difference in the cost of producing, here and abroad, any commodity on which a rate change has been requested, that Mr. Smoot would base all changes made under the flexible tariff.

In this respect he disagrees sharply with the House Ways and Means Committee, which wrote the flexible provision into the new tariff. In the 1922 tariff—now in operation—changes in rates made through the flexible provision *are* made on this basis of difference in production costs between the foreign and the American articles. Smoot wants that method to remain in the new tariff. But the House version of the new bill carried another theory into the flexible tariff. The bill as sent to the Senate permits changes under the flexible ruling to be made on the basis of *conditions of competition* in our markets. The House theory is that such increases or decreases in tariff duties should be made to equalize the conditions of competition, rather than any difference in costs of production.

Assuming that the flexible provision will remain in the new tariff despite the efforts of Democrats and Progressives to strike it out, we still have a conflict over the basis for employing the flexible feature.

We are inclined to believe the House was wiser in seeking to equalize *conditions of competition* rather than merely production costs between European and American industries. Investigating abroad the costs of manufacturing is a job that has given our Tariff Commission no end of trouble. Then there is always the question: Are we playing absolutely safe in changing duties in our tariff merely on the basis of a difference in costs of production? Is this a fair standard for protective measures? There are in Europe—and well does our chemical industry know this—cartels which market products after they are produced by other cartels or other units in the same cartel, and too often the real competition is created by their skillful marketing methods, not by their costs of *production*. This thought was plainly behind the change made in the flexible provisions by the House Committee. For in making its report on the proposed tariff act (Page 158) the committee commented as follows:

> It was found that the costs of [foreign] production alone did not accurately reflect competitive conditions, and that equalizing costs of production would not be sufficient to avoid damaging competition to a country's industries. Foreign and domestic competition in the markets of the United States must be equalized.

The conflict raging over the flexible tariff has its political not less than its economic aspects; Senators have aligned themselves on either side of the issue by parties rather than on the principle of the issue itself, and so the debate may be waged hotly for a week or more. But again, to-morrow may see the thing settled. That's your typical tariff weather—consistently uncertain.

LOWELL TEXTILE INSTITUTE OPENS

Lowell Textile Institute will start its college year on the first of October. Registration for all classes other than the senior took place previous to September 26, at which time the freshman class was given an address of welcome by the president, Dr. Eames, and was also presented to the members of the faculty. As has been the case in previous years, the regular orientation program will be carried out, and the first-year men will have outlined to them the various extra curricula activities. The customary banquet and social entertainment for the new students was held the evening following the completion of registration.

Profs. James Guthrie Dow and Herbert J. Ball, of the institute faculty, have charge of the orientation program. President Eames said registrations are being received in every mail now, and beyond doubt the enrolment will be equal to that of a year ago.

SWISS DYE EXPORTS INCREASE

Consul Albert W. Scott, of Basel, through the United States Department of Commerce, has issued the following bit of information: According to officials of local dye plants, the production of dyestuffs in Basel has shown a further increase in later months, compared with corresponding months of 1928, when the production was greater than in any other year previous to that. Statistics are not yet available for June, but for the first five months of 1929 Swiss exports of aniline dyes were valued at 31,713,000 francs ($6,057,000), as against 30,628,000 francs ($5,911,000) for the same period of 1928. Factories in the Basel district, of course, manufacture practically all of the dyes exported from Switzerland.

Germany is at present taking the largest share of the Swiss dye exports, followed by France, Great Britain, the United States and Italy, in the order named. Exports to the United States were slightly lower in the second quarter of this year than the first quarter, but considerably higher in value than in the second quarter in 1928. The value of declared exports of dyestuffs to the United States from the Basel district was $431,921 in the June quarter, 1929, against $487,867 in the March quarter of this year and $281,183 in June quarter 1928.

Research On Textiles*

By Henry D. Hubbard
Assistant to the Director, Bureau of Standards

TO spin yarn and weave cloth is an ancient art. Power looms have made it a giant machine industry. It is easy to visualize a loom; not so easy is it to picture the infinite detail of processing which makes the weaver's art. The Bureau of Standards, with its experimental textile cotton and knitting mills, is equipped to produce many kinds of woven fabrics, and is engaged in researches in which desired characteristics are being designed into types of fabric of great diversity and utility. Research is transforming the textile industry.

Weaving is so old that we see it in the nest building of birds, while spinning is the art of spider and silk worm. Man now spins his own fibers in attempts to duplicate nature's finest fiber—silk. Meanwhile we are learning how to build any desired quality or characteristics into fabric. This is done by measuring the characteristic, then building the measures into the yarn spin and weave. The Bureau deliberately built a cotton fabric as a substitute for linen for use as airplane wing cloth when the world's linen supply was cut off.

Each of the endless varieties of textile products presents problems for the technician, the solution of which enhances their utility, creates new uses and promotes comfort and well-being of the user.

How quickly a parachute opens when the draw string is pulled depends upon two fabric qualities—slip quality and resiliency. The first step is to measure these. The Bureau is developing methods and devices for measuring these characteristics and for measuring the permeability of the fabric to air. The development of these devices will give basic data pointing the way to improved parachute fabrics. Injury was found in such fabrics which was traced to the abrasion and burning when the fabric rubs on the shroud lines. This was minimized by suitably oiling the lines.

Substitute for Parachute Silk

In the search for a good substitute for parachute silk, it was found that cotton yarn treated with cellulose ester dope, combined with mercerization, produced a yarn with many equivalent properties of silk. Some twenty-six fabrics were examined for suitability. It was found that parachute silk of American make could be made equal to or superior to imported cloth. To insure the high quality desired the Bureau drafted technical specifications.

For balloon gas cells and airship cloth it is important in reducing weight to produce a surface requiring minimum rubber covering. In the Bureau's experimental cotton mill some forty-four different fabrics have been woven under constant tension and made up with 90 by 90 threads per inch and different types of weave. They have all been tested for breaking strength, stretch, tear, weight, thread count, crimp, and yarn size as a basis for selecting the most efficient cloth.

A balloon envelope must be gas tight. Gas-tightness is a primary merit for construction of balloons, dirigibles, and kite balloons in which hydrogen is used. Test methods were developed by the Bureau to measure this essential quality. They are judge and jury of permeability.

In a rubber-coated balloon fabric the hydrogen and the air pass through the rubber film in opposite directions, each dissolving in the rubber in the process. The effects of temperature, pressure, humidity and time were carefully measured as a basis for improving the performance of balloon fabric.

The heat-retaining property of fabric is a most useful characteristic of clothing and bedding. For blankets it is a chief merit. To buy a blanket is to buy heat retaining power. The measurement of the rate of heat transfer through blankets then becomes the criterion for judging their primary utility.

Such apparatus and the technical method for measuring the heat-insulating quality of blankets were developed in the textiles laboratory of the Bureau of Standards. Heat insulation varies with the number and size of the enmeshed air cavities, and the ease with which air passes between them. This may be controlled in the manufacture if suitable measured data are available. The research developed the importance of weave structure in retarding the escape of heat through a fabric.

The outcome of the research was to stimulate the production of blankets with enhanced heat-retaining quality. The conservation of this quality in laundering was also given consideration and "re-napping," if effectively done, retains this quality. Re-napping is now a laundry operation.

Testing Tire Fabrics

When cotton fabric was the framework of automobile tire construction it became important to devise test methods of the desirable traits of such fabric in order to measure strength and serviceability. It was found that air moisture might contribute as much as 8% to the weight of the tire, and when used to increase the strength might be as high as 10%. The standard test methods devised by the Bureau avoided or settled disputes and permitted more accurate comparison of quality, so that gradual improvement might be effected with each new lot studied.

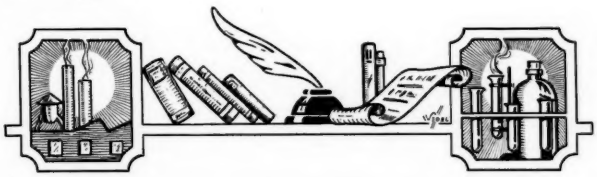
*One of a series of articles on Industrial Research appearing in the United States Daily.

When cord tires were first produced the Bureau was asked to co-operate in studying the relative efficiency of fabric and cord tires. It was the Bureau's demonstration of the high efficiency of the cord tires that is credited with the rapid and practically complete transition to the cords, at a saving estimated by the industry as equal to $40,000,000 a year to the users of automobile tires.

A device is now built at the Bureau to stimulate the effect of walking wear of carpets and rugs. A horizontal stress and a vertical pressure (150 pounds) are provided so that a slippage caused by the rotation of a disk produces wearing stresses comparable to that caused by the movement of the shoes in walking. The measure of wear with this instrument is the thickness of the carpet.

With this device both the wearing forces and the resulting wear can be accurately measured and directly correlated. This is typical of the simulated service measurements which are characteristic of laboratory research.

A study is in progress based upon the results with the object of determining the relation between the carpet structure and the resulting wear. From the result of this research carpet and rug makers may design their fabrics to minimize wear and prolong the service life of these useful and ornamental floor coverings.



RECENT LITERATURE

The Cotton Year Book

Manufacturers Year Book 1929. Pages 359, published by the National Association of Cotton Manufacturers, Boston, Mass.

The 1929 edition of the Year Book of the National Association of Cotton Manufacturers, reference work of the cotton manufacturing world, is being distributed. More new material has been added in the current issue than in several years, as a number of new reports of special interest to the industry were inaugurated during 1928.

"For the first time the cotton manufacturer has a detailed picture of the particular parts of the cotton crop in which he is interested," writes Secretary Russell T. Fisher of the Association in the preface.

"The data from the census of 1927," continues Mr. Fisher, "are more descriptive of the industry, as they include not only more sub-divisions by classes of fabrics, but divide the production of cloth into groups of fabrics with yarn numbers averaging 40's and below and above 40's."

Among the other new features are more comprehensive statistics on looms. Tables give the number of looms and the different types of looms in the various individual States, as well as the total for the country and also show the number of active and idle looms.

That there has been a continuity of overproduction at high cost throughout the industry during the past few years is clearly indicated in the compilations in the year book, according to George W. Summersby, chairman of the statistical committee.

The present volume while more than three times the size of the original is, nevertheless, a compact reference work, owing to the fact that changes and eliminations have been made from time to time. It is believed to contain practically all of the information that persons in the industry and others interested might seek in such a book. Its sales over the thousand or more distributed to members of the association have more than tripled in the past few years.

Development of Industry

Industrial Development in the United States and Canada —1926 and 1927. Policyholders' Service Bureau, Metropolitan Life Insurance Company, New York.

The extent and character of what is popularly known as "migration of industry" has been the subject of an exhaustive study that has been completed by the Metropolitan Life Insurance Company in co-operation with the Civic Development Committee of the National Electric Light Association. The general objects have been two: First, to measure in terms of number of plants and employees the extent and nature of these phases of development; second, to determine the underlying economic reasons which have brought about these changes. This small booklet gives a summary of the results.

Dry-Cleaning Solvent

Stoddard Solvent (Dry Cleaning). Commercial Standards CS3-28. Bureau of Standards. 20 pages. 10 cents.

On December 2, 1927, a joint conference of representative manufacturers, distributors and users adopted a standard for Stoddard Solvent. The dry cleaning industry has since accepted and approved for promulgation by the Department of Commerce the specification as shown in this booklet.

Textile Specifications

General Specifications for Textile Materials (Methods of Physical and Chemical Tests). 6 pages. 5 cents.

Denim, Brown (unshrunk), U. S. Government Master Specification.

Denim, Blue (shrunk), U. S. Government Master Specification.

Denim, Blue (unshrunk), U. S. Government Master Specification.

Wool Bunting, U. S. Government Master Specification.

Alphabetical Index and Numerical List of United States Master Specifications, promulgated by the Federal Specifications Board. (Complete to June 30, 1928.) Bureau of Standards. 20 pages.

Textile manufacturers who wish to keep informed on the specifications laid down for textiles by the Bureau of Standards for the use of the Government will find the testing methods of interest. Anyone who tests the properties of textiles will find the Bureau's tests valuable for comparison. The Alphabetical Index lists specifications issued for many other products besides textiles.

First-Aid Information

Practical Aspects of Resuscitation. By Edward Steidle. Mine Safety Appliance Company, Pittsburgh, Pa.

The subject of resuscitation is of particular interest to the chemical engineering industries. Many chemical companies and mills in which dangerous chemicals are used in processing are teaching their employees the art of giving artificial respiration. This very helpful booklet deals in a practical way with the problems of reviving persons overcome by smoke, gases, chemical vapors and other causes. Mill safety committees should obtain a copy at once and make its contents known. The Mine Safety Appliance Company, of Pittsburgh, will supply copies free on request.

Gas Warfare Casualties

World War Casualties from Gas and Other Weapons. By Col. H. L. Gilchrist. Chemical Warfare School, Edgewood Arsenal, Md. Illustrated, 50 pages.

This is a comparative study dealing with the casualties from gas in the World War, and with casualties from other types of weapons, and its statistics and arguments attempt chiefly to prove the humaneness of gas warfare. One of its purposes is to clear up a prejudice against the use of chemicals in warfare. It deals largely in figures and is profusely illustrated with charts, some in color.

Directory of Industrial Associations

Commercial and Industrial Organizations of the United States—1929 *Edition.* Domestic Commerce Series No. 5, United States Department of Commerce.

In the development of associations and trade groups in practically every industry in the United States the observer of new conditions and trends in American industry may see the healthful results of all that preaching for co-operation which filled the air a score of years ago. This government directory of trade and commercial organizations lists more than 13,000, an increase of nearly 50 per cent over the 1926 record. National, international and interstate organizations are classified by services and commodities and arranged alphabetically. State and local groups are listed by States.

Pigments

Tinting Strength of Pigments. By H. D. Bruce. Research Paper No. 7, United States Bureau of Standards. 25 pages, illustrated. 10 cents.

This book does not primarily propose to offer a new method for estimating and expressing tinting strength, but rather to aid in clarifying ideas on the subject, so that when the science of colormetrics has been further advanced a rational means for appraising this valuable property may be more easily developed.

The necessity of considering the tinting strength of chromatic pigments as a two-factor property is shown. Distinction between the strengths of white and of black are drawn. A method for treating the properties of pigments photometrically or spectrophotometrically and of indicating their relative magnitude by numeral indices is suggested. Tabular and graphical data are presented.

We Might Also Mention—

Autumn may be the death of Summer but it brings to life innumerable technical societies and associations that suspended their activities last Spring. . . . Committee chairmen begin to hop about, plan their speakers' programs for the coming winter meetings . . . pester the life out of numerous executives of mills, dyehouses, chemical plants, with "Can't you help me out with a paper next month—oh, anything along your line will be okay; we haven't had anything from you in two years and a lot of new members will want to hear you," etc., and ad infinitum. . . .

Now, of increasing interest among technical groups are the bibliographies of chemical and textile literature which are issued from time to time . . . new compilations being planned . . . subjects divided and sub-divided . . . lists of books, articles, papers, in each sub-division . . . so it goes . . . a great and commendable effort to save everything in chemical literature of any value . . . and there's so much to be gone through before the best can be weeded out! . . . the task seems hopeless . . . especially to anyone who has never made bibliographies . . . if such there be. We had recently brought to our attention again a book issued late last year, "Chemical Publications: Their Nature and Use," by Melvin Guy Mellon, published by McGraw-Hill Book Company . . . it should be of genuine interest to those who found Crane's and Paterson's book, "The Literature of Chemistry," a valuable guide. . . .

Something in the nature of a bibliography was issued recently by the American Management Association . . . a list of its publications . . . this includes a few titles that foreman dyers and efficient (or inefficient) mill executives will want to read . . . for instance, "Organizing for Production in Cotton Manufacturing" or "Relations of the Supervisor to His Men" . . . and still others like "The Foreman's Place in a Training Program" . . . "The Foreman as Manager: His Responsibilities in Relation to the Business as a Whole" . . . surely there will be many

an ambitious mill man writing to the American Management for these . . . their prices are low, 75 cents and a dollar. . . .

Talking of production (as the boss dyer always is) a number of useful little booklets have been issued during the past month or so by the Policyholders' Service Bureau of Metropolitan Life Insurance Company, New York . . . we have mentioned this Bureau here before . . . the title of one is "Functions of the Production Executive" . . . this exerpt from it, on Tests and Experiments, is of interest to those who keep an eye on the research activities of the big industrialists: "Research laboratories or experimental and testing departments are not to be found in all industrial organizations," says this booklet. . . . "The character of the product manufactured and the nature of the processes involved rather than the size and scope of the project ordinarily determines the relative importance of this feature to an organization" . . . which is merely another way of saying that because a plant or mill is small is not a reason why it should not need a research or testing lab . . . specific companies are mentioned as maintaining active testing and experimental staffs, such as Du Pont, Atlantic Refining Company, etc. . . .

Many readers may not yet know of the series of bulletins issued as part of a study of better business through research in New England industry . . . these were also prepared by the Metropolitan Life's Service Bulletin and the titles give a hint of their range . . . among the reports in the series were several on applying research to production . . . one of these is entitled "The Use of Research in Standardization and Simplification," "Enlisting Outside Research Facilities" and "An Association for Improving Standard Methods" contain material of value to the thousand or so technical men in the textile industry (we hope there are that many) who keep informed on the standardization movement. . . .

New England is certainly not neglected in these days of Southern booming . . . the Government's busy Department of Commerce has issued two bulletins, "New England Manufacturers in the Nation's Commerce" by Charles E. Artman of the Domestic Commerce Division, and "The External Trade of New England" by R. J. McFall, also of that division . . . at ten cents each they provide excellent data for all those who feel inclined to fight about the foolish notion that New England is slipping as an industrial center, particularly as a textile center. . . .

This week in Chicago several hundred men have gathered to discuss ways and means of making this a safer world to live in . . . it is none other than the annual National Safety Congress, sponsored by the National Safety Council . . . as we reported in the last issue, textile men are on the program to talk over plans for reducing accidents in the mill, the laboratory, the dyehouse . . . many mills have their safety committees and the members should find of greatest interest two booklets issued by the Metropolitan Life . . . not that we are striving to advertise this company, but many of its booklets are too interesting to pass by . . . these, to return to our topic, are entitled "Directing the Plant Safety Work" and "The Foreman's Part in Safety" . . . one mentions the qualities of a safety director: "A sincere personal interest in human relations, enthusiasm and the ability to become a friend and leader of men" . . . which strike us as so general that the same qualities can be called the best for a good dyehouse foreman . . . or even a good dyer if one has an eye on the job ahead . . . but get the safety booklets and read them. . . .

We mentioned a few paragraphs back the busy Department of Commerce . . . now, if one were to ask us which is the busiest bureau in this Department we would hesitate to award the title for fear of bringing a shower of abuse upon our much-abused head from the chief of some busier bureau . . . but the Bureau of Standards should be near the top of the list . . . a visitor's manual to this bureau has been issued by the Government, giving a brief account of its history, functions and laboratory facilities . . . if you're going to Washington next week or month write for a copy . . . and drop in to see the Bureau . . . shake hands with William Appel, who heads the Textile Section and who is well known to many of our readers as an active member of the Research Committee of the A. A. T. C. C. . . . and when we say "active" we are not merely referring to his class of membership . . . and make sure, any visitor to the Standards Bureau, that you also shake William Smith's hand . . . he is Research Assistant for the A. A. T. C. C. and responsible for some of the work on fastness tests which have been reported in the Proceedings. . . .

And while in Washington see the exhibit prepared under the auspices of the National Research Council with the co-operation of the chemical Warfare Service of the Army . . . this is now permanently installed in the Smithsonian Institution . . . the central feature of the exhibit is a topographical model representing an idealized group of chemical industries such as are required in the production of dyes, war gases, pharmaceuticals and explosives . . . but this is not the time to talk more of chemical warfare, with the air filled with optimism over peace treaties and disarmament . . . 'nuff said.

C. H.

BRITISH DYEING FIRMS AMALGAMATE

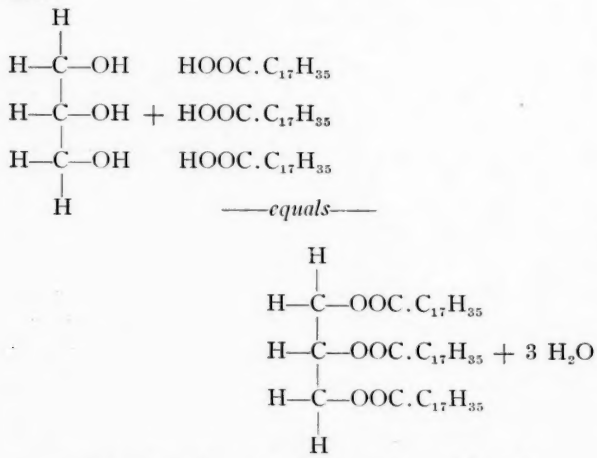
Stevenson Bros., Ltd., a large local dyeing and cleaning establishment, reports Consul John J. C. Watson, of Dundee, became amalgamated with other large dyeing and cleaning establishments in Scotland and England, under the name of the Associated Dyers and Cleaners, Ltd. The managing director of the company announces that as few changes as possible would be made in the management of the Dundee business, and that the policy of Stevenson Bros., Ltd., would be maintained.

SOAPS

(*Continued from page 642*)

and the production of saturated ones thereby. Oils which are known as semi-drying and drying oils contain unsaturated carbon atoms in the formula. Linseed oil used in paints is a drying oil. When the paint is first applied to a house the linseed oil (which contains several unsaturated carbon atoms) is unsaturated. The unsaturated carbon atoms gradually take up oxygen from the air, and the linseed oil is changed from an unsaturated to a saturated oil and the oil or paint hardens.

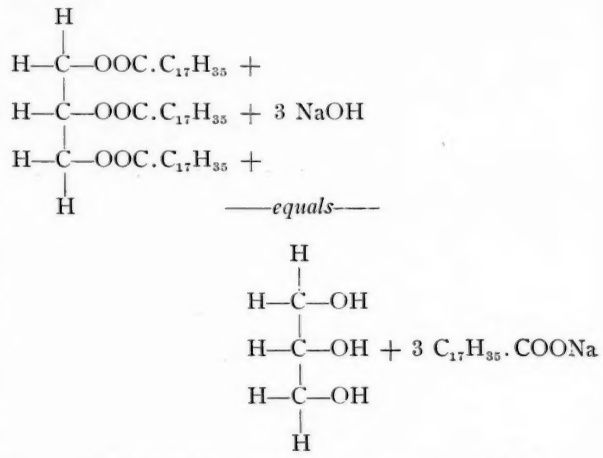
The formula for glycerine and for typical fatty acids has now been given. It is now necessary to give the formula for fats, or glycerides, as they are also called. As a typical example we will consider the fat or glyceride of stearic acid. It has the formula represented by C3H5 ($OOC—C_{17}H_{35}$)3, and may be considered as being formed when 1 molecule of glycerine unites with 3 molecules of stearic acid with the elimination of 3 molecules of water (H_2O), and may be represented thus: $C_3H_5(OH)3 + 3(C_{17}H_{35}.COOH) = C_3H_5(OOC—C_{17}H_{35})3 + 3\ H_2O$, and may be represented pictorially thus:



1 part glyceride + 3 parts stearic acid = fat (glyceride of stearic acid) + 3 parts water.

Now that we have the formula for a fat or glyceride, we will see what takes place when soap is made from a fat by treating the fat with an alkali like caustic soda. Tallow is a commonly occurring fat used in soap manufacturing, and consists mainly of the glyceride of stearic acid along with varying percentages of the glycerides of other fatty acids, such as oleic acid.

For convenience we will consider the manufacture of soap from the glyceride of stearic acid. On a large scale the fat or glyceride is melted in a large iron tank by means of steam and a strong solution of caustic soda gradually added. The mixture is boiled vigorously, and during the boiling the fat breaks down into glycerine and free fatty acid. The fatty acid set free at once combines with the caustic soda solution to form a soap. The reaction taking place is as follows: One molecule of the glyceride (fat) of stearic acid combines with 3 molecules of caustic soda to form 3 molecules of sodium stearate (soap) and 1 molecule of glycerine. This the chemist pictures—



1 part glyceride (fat) + 3 parts caustic soda = 1 part glycerine + 3 parts soap.

Or, figuring over to a pound basis, 890 pounds glycerine stearate plus 120 pounds caustic soda will give 1,095 pounds sodium stearate soap plus 92 pounds of glycerine.

Eight hundred and ninety is derived from molecular formula glyceride = $57 \times 78 + 110 \times 1 + 6 \times 32$. The molecular formula contains 57 atoms of carbon, each atom having atomic weight 12; 110 atoms of hydrogen, each atom having an atomic weight of 1; and 6 atoms of oxygen, each atom having an atomic weight of 16.

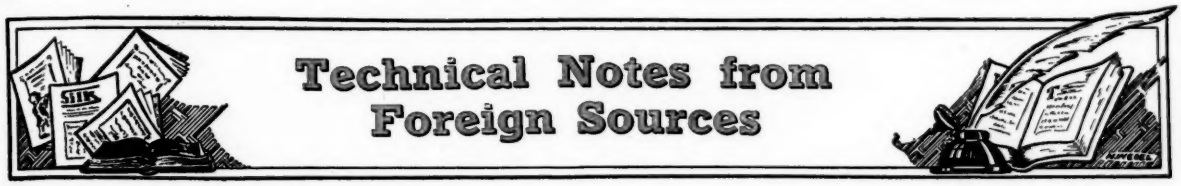
One hundred and twenty is derived by multiplying by three the molecular weight of caustic soda. The molecular weight of NaOH is 23 + 16 + 1 = 40. It contains 1 atom of sodium with an atomic weight of 23; one of oxygen with atomic weight of 16; one of hydrogen with atomic weight of 1. Since 3 molecules (parts) of NaOH are required, the weight needed is $3 \times 40 = 120$.

Ninety-two is the molecular weight of glycerine, and is obtained by adding together 3×12 (atomic weight of carbon) + 6×1 (atomic weight of hydrogen) + 3×16 (atomic weight of oxygen), the molecule of glycerine containing 3 atoms of carbon, 6 atoms of hydrogen and 3 atoms of oxygen.

One thousand ninety-five is obtained by multiplying by three the molecular weight of sodium stearate, which is 18×12 (atomic weight of carbon) + 2×16 (atomic weight of oxygen) + 35×1 (atomic weight of hydrogen) + 23 (atomic weight of sodium [Na]).

(*To be concluded in an early issue.*)

J. Takamine, Jr., has left for Japan as a delegate of the American Chemical Society to the World's Engineering Congress in Tokyo, October 27 to November 27, 1929.



Indigoid Vat Dyestuffs

German Patent No. 441,439; *Kalle u. Co. A.-G.*—In German Patents Nos. 241,997 and 269,123, dull-toned vat dyestuffs suitable for gray and black shades are described as produced by condensation of isatine-alpha-derivatives with hydroxyl-naphthol-carbazoles. In the present patent, hydrogenated hydroxy-naphtho-carbazole-carbonic acids are so used. The isatine-alpha-derivatives include homologues, analogues, and substitution products. The dyes cited in the three examples of this patent dye wool and cotton in dull-blue violet to dull-blue tones.

Indigoid Vat Dyestuffs

German Patent No. 431,674 (*addition to German Patent No.* 425,352); *Gesell. f. Chem. Ind. in Basel.*—The original patent covers the preparation of anthraquinone-2-thioglycol-3-carbonic acid and of 2-3-anthraquinone-hydroxy-thionaphthene, and the synthesis of indigoid dyestuffs from them. The present addition covers the condensation of 2-halogen-anthraquinone-3-carbonic acid with glycoll to form anthraquinone-2-glycino-3-carbonic acid, the conversion of this to an indoxyl derivative, and the conversion of this last to indigoid dyestuffs, using it either as such, or after hydrolysis, and either with oxidizing agents or with other compounds suitable for condensation with it. The products ultimately obtained may further be halogenated if desired. Eight examples are given. The products dye cotton from a hydrosulphite vat in fast red-blue to green and to blue-black tones.

Indigoid Vat Dyestuffs

German Patent No. 445,443; *Gesell. f. Chem. Ind. in Basel.*—Beta-naphthol-thio-furane-1-2-dione is condensed with cyclic compounds of the type of beta-hydroxy-thionaphthene or with acenaphthenes; the products may be halogenated. These dyestuffs dye wool and especially cotton in shades from orange through bordeaux to brown, and yield very fast dyeings. The halogenated (brominated) products are pure blue in tone.

Vat Dyestuffs of Perylene Series

German Patent No. 445,219; *Felix Benda* (*Genoa*).—Perylene and benzoyl chloride, or benzoyl-perylenes, are treated with anhydrous aluminium chloride at a high temperature. Dibenzoyl-perylene (Ber. d. d. ch. Ges. 43, 11, S. 2208) yields a dyestuff dyeing a lovely violet-blue from a blue-violet vat. The compounds are apparently highly condensed.

Perylene Dyestuffs

German Patent No. 432,178; *Kalle u. Co. A.-G.*—Perylene itself or its derivatives, when treated with strong sulphuric acid or oleum or chlor-sulphonic acid, passes through various sulphonic acids to dyestuffs of the vat series, according to which agent mentioned is employed, and according to the degree and duration of heat applied. The reaction is assisted in some cases by oxidizing agents. A perylene-disulphonic acid cited as one product dyes wool from an acid bath a pure greenish-yellow; the vat dyestuffs obtained by more intense action of the reagent dye cotton from yellowish-brown through pure brown to blackish-brown.

Vat Dyestuffs of the Anthracene Series

German Patent No. 441,586; *I. G. Farbenindustrie A.-G.*—Naphthathraquinone or its derivatives is treated below 210° C. with anhydrous aluminium chloride, with or without admixture of other anhydrous metalhalides. Of the derivatives of naphthanthraquinone, the halogen derivatives are specially referred to; e. g., the product obtained by condensation of beta-phthalic anhydride with naphthalene. The products give violet-blue to blue vat dyestuffs of the usual excellent fastness.

Vat Dyestuffs of the Anthracene Series

German Patent No. 443,584; *I. G. Farbenindustrie A.-G.*—o-Diamino-anthraquinone or its derivatives is treated in the heat with various metallic salts or oxides. For example, cupric chloride, oxide, or sulphate, ferric chloride, mercuric or mercurous chloride, barium peroxide, sodium peroxide, cerium disulphate, stannic chloride, antimony pentachloride, lead peroxide, red lead, manganese peroxide, or chromium trioxide are used as the metallic compounds, and the reaction is carried out either by heating in organic solvents, such as nitrobenzene or naphthalene, with addition in some cases of a neutralizing agent such as sodium acetate, or in some cases the reacting components are simply fused together. Further, in this latter case, the product may be subjected to subsequent reaction in a solvent, with the same or a different metallic compound. Not all of the products are vat dyestuffs; those which are so dye cotton mostly dark tones, browns of various shades.

Colored Reserves Under Aniline Black

Dr. S.; Der Textil-Chemiker u. Colorist 10, 35 (1928). The practice of producing colored reserves with basic dyestuffs under Aniline Black is fairly common. The method of production is very simple, and makes possible the preparation of handsome, clear reserve effects, but suffers from the fundamental difficulty of having to combine unfast dyestuffs with a very fast one. The basic dyestuffs are not fixed as well by zinc or manganese ferrocyanide as by tannin. P. Braun (L'Ind. Text. et

Comm.) states that the fastness to soap of the basic dyestuffs can be considerably improved by the use of Katanol. But the use of Katanol together with Prudhomme Black is a difficult thing, for neither the padding solution nor the ordinary reserve pastes permit the addition of the substance. P. P. Sazanoff has solved the problem of the use of Katanol for this purpose, by employing an alkali, which holds the Katanol in solution, and, at the same time, hinders the formation of any lake in the printing paste itself. Still, the process, even if it is exactly controlled, does not give good results with all basic dyestuffs, particularly in reference to their fastness to light.

Chrome dyestuffs, although faster, can find only restricted use for colored reserves under Aniline Black. All tones cannot be produced by them; red, clear yellow, green and violet are lacking. There are also technical difficulties to be overcome.

The problem of fixing the vat dyestuffs under Aniline Black, by means of neutral printing pastes, can be solved along the lines of Haller's patent. H. recommends printing the dyestuffs in the presence of ferrous sulphate and suitable reserves, and developing the dyestuff, after steaming for the black, by a passage through a bath of caustic soda. It is better still to employ the indigosols, which are easy to apply and apparently give good results. Yet their use is again narrowly limited on account of their lack of clear shades, and the relatively high cost of the dyestuffs.

In reference to the possibility of obtaining reserve effects with the vat dyestuffs under Aniline Black, by use of an alkaline printing paste, it has been found that the disinclination of chemists of an earlier date toward the use of an alkaline paste is not justified. Careful choice and careful regulation of the amount of alkali and reducing agent make possible a complete fixation of the vat dyestuff by the alkali hydrosulphite, without the fiber being harmed in any way. Out of the great number of vat dyestuffs on the market, there is available a whole series of Indigoid and Indanthrene dyestuffs, which can be fixed satisfactorily either alone or in mixture. They show only slight sensitivity toward alkali, and the danger of alteration which ordinarily can easily arise during the steaming.

The vat dyestuffs often occur in the form of powder, so that they must be dissolved in the printing paste, for ordinary printing, by reduction through hydrosulphite. If it is necessary to preserve the paste for a considerable time before using it, formaldehyde should be added as a preservative. Sodium hydrosulphite can be replaced by formaldehyde hydrosulphite, but in such a case a longer time and a higher temperature are needed for the reduction. This is especially the case with Helindone Orange R, Thio-indigo Scarlet GG, and Thio-indigo Red B. The reduction is carried out by pasting up the solid dyestuff, warming slightly in a suitable vessel, adding the required amounts of caustic soda, glycerol, and the thickening agent, and heating at 50° to 55° C. for one-half hour. The hydrosulphite is then added, and the mixture allowed to stand for one-half hour. The resulting printing paste will keep for two days, if the reduction is complete. Dyestuffs such as those mentioned require for their reduction less alkali than do the Indanthrenes.

The development of the reserves and of the Aniline Black is accomplished by a 4-minute passage through the Mather-Platt at 101° to 101.° C. The steam should not be too moist.

In printing light-weight cotton weaves, we do not have to fear insufficient fixation, on account of the acid vapors formed in the steaming, since the reserve paste contains enough alkali to neutralize the acid set free. With heavy goods, the method must be modified, so that the action of the acid vapors may be obviated, especially when white reserves are to be obtained. In this case, the printed material is passed for 1 to 1½ minutes through a Preibisch oxidation chamber, in which the air is very rapidly renewed, and then passed through the Mather-Platt.

The goods are finally chromed hot (15 g. of sodium bichromate and 10 g. of 30% acetic acid per liter), in order to develop the black completely and to attain complete fixation of the vat dyestuff. The goods are then soaped full width. The reserves so produced are usually clear, and the black, particularly on mercerized material, deeper than usual.

Aftertreatment of Unevenly Dyed Viscose

Kunst-seide 10,503 (1928).—A communication from Courtaulds, Ltd., states that viscose silk, dyed with direct cotton dyestuffs, and showing uneven dyeing, can frequently be improved in appearance by aftertreatment with a bath of beta-naphthol and common salt. The bath should contain 1 pound of beta-naphthol and 1 pound of common salt for 10 gallons of water and is used hot. The naphthol, in these proportions, does not entirely dissolve, the undissolved excess floating in the bath as fine crystals. The goods are worked for 30 minutes in the bath at 90° C., or even at a higher temperature if possible. When working with yarns, it should be noted that the introduction of a lot of cold yarn frequently lowers the temperature of the bath from 90° to as low as 70° or so, and the temperature should be raised (with due care to protect the yarn from live steam) to 90° again. A temperature below 90° gives poor results.

After treatment, the goods must be carefully washed, best in warm water or in a soap bath, to remove the beta-naphthol. Any naphthol left on the goods shows up later as a brown stain. If a dark scum forms on the surface of the bath, it must be scooped off with the greatest care, since, when it has become adherent to the viscose, it is very difficult to remove.

The beta-naphthol can be gotten into complete solution, of course, by careful use of caustic alkali, but there may be danger of reaction of the alkali with the dyestuff or the viscose, or possibly with both.

Alternatively, dyeing can be carried out in a 1% solu-

tion of beta-naphthol and common salt, instead of plain water as the solvent. The results are good in this case, but the aftertreatment method is the better.

No claim is made that in any case a defective dyeing is made perfect, but that in many cases a decided improvement is attained. In a few cases, no improvement is to be noticed; e. g., with Chlorazol Fast Orange AG and Benzo Fast Brown GL. The process cannot be used with goods which contain acetate silfl, nor can it be used with viscose dyed with other than direct cotton colors.

Mordanting of Cellulose Esters or Ethers

British Patent No. 286,761; *Henry Dreyfus.*—The goods, especially cellulose acetate, are treated with a solution of such metallic salts as chromium chloride, chrome alum, aluminium sulphate (not ferric salts), of a concentration of about 15% at the lowest. Protective compounds such as common salt, Glauber salt, ammonium chloride, or glue, or other protective colloids, are also added to the bath to prevent the goods from becoming more or less delustered.

GENERAL DYESTUFF ISSUES NEW CARDS

The General Dyestuff Corporation has recently issued several cards, one illustrating a new color, Indanthren Yellow 3H Paste; "Vat Colors on Spun Silk," "Colors on Tin-Weighted Silk" and "Dyeings Fast to Salt Water on Woolen Yarn."

That on "Colors on Tin-Weighted Silk" purports to show a wide range of dyestuffs representing a selection of products which have good affinity to tin-weighted silk when dyed according to the usual phosphate method. For each color a wash and blending test is shown which will be of great help to the silk dyer for the proper selection of colors for wash goods. The card also gives data about the fastness to light and dischargeability of the products illustrated.

In the booklet on "Dyeings Fast to Salt Water on Woolen Yarn" the General Dyestuff Corporation shows a range of shades produced with acid colors especially adapted for the dyeing of woolen material for sweaters and bathing suits. They are described as distinguished by their very good fastness to water and salt water and washing; white wool or cotton used alongside is not stained. The fastness to light also represents the best obtainable for the individual shades.

CARD ON FAST SHADES GIVEN TO TRADE

The Carbic Color & Chemical Company, Inc., has distributed to the trade a new pattern card, issued a short while ago by Durand & Huguenin, illustrating "Fast Shades on Slubbing and Loose Wool with Indigosols." It is printed in three languages—English, French and German—and goes into detail on the dyeing method in these processes.

DU PONT PRODUCTS EXHIBIT STRESSES DYE FASTNESS

A series of four displays emphasizing the fastness of American-made dyes has been a feature of the Du Pont Products Exhibit at Atlantic City during the late summer and early fall. In order to give the widest possible publicity to the displays, the large windows of the exhibit facing the boardwalk were dressed in a manner to carry the message of fastness to the passers-by and to visitors to the Exhibit. In addition, further displays inside the Exhibit along the same line were shown and the floor staff explained to visitors the progress made in dyestuffs. The series attracted great attention.

Among the manufacturers whose fabrics were shown were the following: Utica Steam & Mohawk Valley Cotton Mills, of Utica, N. Y.; Halifax Cotton Mills, Inc., of South Bristol, Va.; Pontiac Finishing Plant of B. B. & R. Knight Corporation, of Pontiac, R. I., and the Leakesville Woolen Mills, of Charlotte, N. C.

GERMAN NITROGEN WORKS IS BACKED BY AMERICANS

William T. Daugherty, United States Trade Commissioner in Berlin, has informed Washington that funds in the form of a loan of $3,000,000 advanced by an American bank in association with German banks to the Ruhr Chemie A. G., of Essen, Germany, will be used to double the company's fixed nitrogen production. This company, which formerly was called the Kohn Chemie, borrowed $8,000,000 upon a previous occasion.

The Ruhr Chemie A. G. started production in May, 1929, with its new nitrogen fixation plant at Sternrade-Holten, operating a Casale ammonia synthesis utilizing waste coke-oven gas-hydrogen. The new loan bears 8% and runs for six years. It will be used to extend Ruhr Chemie's fixed nitrogen production from its present announced capacity of 21,500 metric tons nitrogen in ammonia, nitric acid and fertilizer to 50,000 tons.

LOWELL PROVIDES SCHOLARSHIPS

The City Council has passed an ordinance providing for the establishment of scholarships at the Lowell Textile Institute, for which Lowell students will be eligible. Two scholarships are to be provided each year, furnishing tuition to their holders for four years. The ordinance was drawn up on petition of Hugh F. Downey, a member of the School Committee.

Fiber which contains mineral matter is not pure fiber; but neither is dyed fiber for that matter. And silk in its natural state lacks those qualities for which the manufactured product is most prized. The point is that a relation should be established in the buyer's mind between price and performance. There is no excuse for any device which takes the buyer's money without giving a fair return.—*Silicate P's and Q's.*

NEW DIAZO COLORS ON THE MARKET

The General Dyestuff Corporation has recently announced the addition of three colors to its line, a new Diazo Fast Yellow 3GL, Helindon Brilliant Yellow Conc. Powder, and Palatine Fast Brown RN. Circulars have been prepared to give the properties of these new dyes. The same corporation has also published a new sample card showing a line of shades for men's wear produced with Palatine Fast Colors under the number of I. G. 181.

It is claimed that the new Diazo Yellow 3GL when developed with Developer Z produces very bright, greenish yellows of a fastness to light, which has so far not been obtainable, and of a good fastness to washing and cross dyeing.

The circular about the Helindon Brilliant Yellow states that it produces exceptionally bright yellow shades which have all the good fastness qualities of Helindon colors, of which the excellent fastness to light, washing, and milling may be mentioned. Combined with Helindon Blue 3G Conc., bright green shades can be obtained.

Palatine Fast Brown, according to the bulletin, dyes very level and is especially recommended for combination shades. It is of a splendid fastness to light, washing and carbonizing, as well as to fulling. It should be of particular interest for the dyeing of woolen pieces for men's wear and better grades of women's dress goods, for carpet and knitting yarn, and for hat dyeing.

NEWPORT MAKES CHANGES IN BOSTON

The Newport Chemical Works, Incorporated, at Passaic, New Jersey, has leased a large section of the second floor of the new building at 80 Broad Street, at the corner of Franklin, in Boston, for the future housing of facilities with which to serve the northern New England area. Besides a suite of spacious and well-lighted offices, a large section will be used as storage for stocks of dyestuffs and other Newport products used in the district.

This warehouse will be equipped for re-packing, and the location of the building, it is stated, enables quick shipment to all New England points.

The new quarters will be occupied October 1. The telephone number is Hubbard 7073.

W. A. Keating, for a number of years manager of the Boston office, recently asked to be relieved of the responsibilities owing to ill health. Acting upon his recommendation, W. R. Zillessen has been appointed as his successor.

The New Hampshire Mills, Inc., Manchester, N. H., has leased one floor of the Amoskeag No. 12 mill, in that city, and will expand its manufacturing unit within a short time.

CHEMIST WANTED

Wanted—Junior chemist for print works. State experience; salary expected. Address: Classified, Box 548, American Dyestuff Reporter.

LABORATORY CHEMIST

Wanted—Textile chemist colorist for dyehouse laboratory doing routine and development work. Give details of textile school or college training and experience, if any. Replies should be addressed to Box 549, American Dyestuff Reporter.

DYESTUFF SALESMAN WANTED

Old-established manufacturer of a complete line of aniline dyes, also complete line of soluble oils, sizes, softeners, etc., for the textile, leather, and paper industries has opening for two experienced salesmen; one with good following in States of New Hampshire and Massachusetts and another in Philadelphia territory. Good opportunity for men with ability, initiative and technical knowledge. Salesmen in the organization know about this advertisement. Replies held in strict confidence. Address: Classified Box 547, American Dyestuff Reporter.

CHIEF CHEMIST WANTED

Wanted—Young man capable of taking charge of laboratory in dyehouse. Should have knowledge of application of all kinds of cotton colors; also wool colors. Textile school or college graduate preferred. Replying state experience, education and salary expected. Box 550, American Dyestuff Reporter.

SALES EXECUTIVE

Nationally known manufacturing chemists for the Textile Industry have a vacancy for experienced sales executive with selling ability, for the New England States: Maine, New Hampshire, Vermont and Massachusetts. This advertisement will attract the attention of men who have a large following among the woolen and worsted mills, bleacheries and dyehouses, and who are thoroughly conversant with the application of wool and rayon oils, sulphonated oils, emulsions, penetrants, etc., but who are desirous of becoming connected with an aggressive organization which assures greater earning powers. First letter must state age, qualification and experience. All letters treated strictly confidential. Address: Classified Box No. 551, American Dyestuff Reporter.

MANUFACTURING CHEMISTS

Nationally known manufacturing chemists seek the services of an experienced manufacturing chemist who thoroughly understands the production, development and application of printing and finishing gums for the textile industry. Unlimited opportunity offered man of experience. State age, qualification and full information in first letter. Correspondence strictly confidential. Address: Classified Box No. 552, American Dyestuff Reporter.